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VIEWS, NEWS AND INTERVIEWS.

The development of the country by means of electric tramways is being rapidly pushed forward in Switzerland, observes a London contemporary. About 69 miles are in operation and 65 miles under construction, while preliminary work has been done on another 200 miles. The gauge is in general one metre, while the rails vary in weight, according to the traffic expected, from 33 pounds to 67 pounds per yard. The overhead system is most generally used, the trolley wire being 0.235 inch up to 0.352 inch in diameter. On new lines the alternate current is being adopted, the distribution being effected at 750 volts. As much as 1,000 volts has been used with some of the older lines having a continuous-current system. The cars used weigh from four and one-half to seven and one-half tons, the smaller seating 22 and the latter 45 passengers. Hand-brakes are most generally adopted. The authorized speed of running is seven and one-half miles an hour in the towns, and 16 miles per hour in the open country.

News comes from Paris that M. Felix Dubois will shortly start for the Soudan, the object of his trip being to ascertain to what extent the country is adapted to the use of electric motor cars.

Fifty-year franchises have been asked of Lake Michigan shore towns for the road that is to be the connecting link in the Chicago–Milwaukee trolley line, now partly in operation. It is proposed to make this trolley road in part a freight line, chiefly for the purpose of connecting Kenosha and other towns with the outer Chicago belt line.

By mixing a harmless powder, subnitrate of bismuth, with the food the movements of the stomach can be seen by means of the Roentgen rays.

A big deal was recently closed in Montreal when Barry, Ross & McRae, contractors, of Niagara Falls, Ont., secured the contract for the construction of a central power-house, etc., for the development of 30,000 horse-power, at Shawinegan Falls, on the St. Maurice River, near Three Rivers, Que. This is to be the greatest power development so far in Canada. The Shawinegan company proposes to develop power in the form of electricity, which will be conveyed to Three Rivers and other places.

It is said that damages aggregating $2,990,150 are demanded from the various trolley companies in Brooklyn Borough, N. Y. It is asserted that there are about 2,000 more suits aggregating claimed damages of $20,000,000 pending for settlement or trial later on.

The United States Civil Service Commission will establish in New York city an eligible register, from which a selection may be made to fill an existing vacancy in the grade of wireman, at a salary of $720 a year, in the custodian service in New York city. Only persons who pass the required physical and mental examination will be considered eligible. Those desiring to take the examination should apply to the secretary of the local board of examiners for application blanks.

The Western Union Telegraph Company's central cable office reports that cable communication with Barbadoes has been reestablished.

Captain Brady, of the United States Signal Service, has been ordered to begin the construction of an overland telegraph line from Guantanamo via Santiago de Cuba to Manzanillo, Cuba. The line is to be used principally for the transmission of government dispatches, although commercial messages will be accepted. The present cost of transmission of messages by telegraph from Guantanamo to Santiago is 20 cents a word up to 30 words and 12 cents for each additional word.

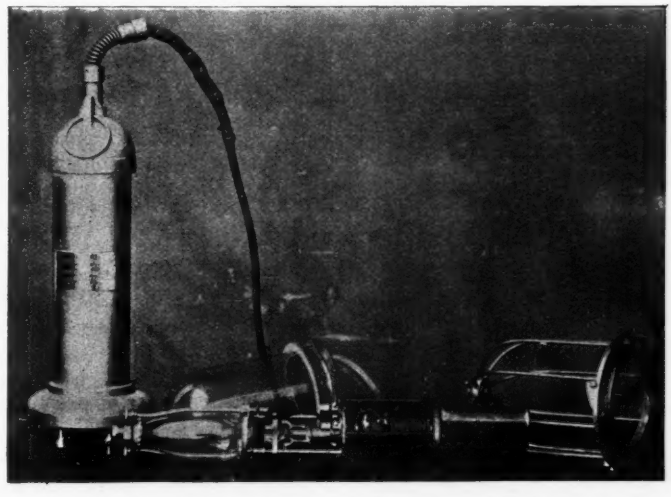

FIG. 1.—A SUBMARINE ARC LAMP DISASSEMBLED.

Mr. William Barclay Parsons, chief engineer of the New York City Rapid Transit Commission, has gone to China in the interests of an American syndicate, which will build a railroad from Hong Kong to Han Kow, passing through Canton.

Mr. H. M. Littell, former president of the American Street Railway Association, and a widely known street railway manager, has left New York city to look after the affairs of the Fairmount Park Transportation Company, of Philadelphia. Mr. Littell will assume the general managership of this well equipped electric railway, and will bring to his duties the experience of years and a high order of ability as a street railway manager.

A SUBMARINE ARC LAMP.

A DEVICE WHICH SHOULD PROVE VALUABLE FOR UNDER-WATER WORK.

A device which promises to be of great value in diving and wrecking operations has recently been patented by Francis G. Hall, Jr., and Irving E. Burdick, of Dansville, N. Y. At the time of the "Maine" disaster, Messrs. Burdick and Hall were connected with Sheffield Scientific School at New Haven, Ct.

The need of positive information as to the nature of the explosion which wrecked the "Maine" led to the investigation of diving apparatus and operations.

The necessity for considerable light for intelligent and efficient work by a diver at some depth below the surface, and oftentimes in the hull of a wreck, demanded some powerful means of artificial illumination.

Various sources of light had been tested under water, but the inherent difficulties in every case seemed insurmountable.

After much diligent research and experimenting, in which the laboratories of the Scientific School played an important part, it was found that, by using a peculiarly constructed containing case and suitable regulating mechanism, the electric arc, the most powerful source of artificial light, could be adapted to subaqueous requirements.

The apparatus consists of a specially designed regulating mechanism, so constructed as to permit of perfect adjustment of the arc in any position.

The containing case is the most important feature of the whole invention, and is made of glass and metal, similar in form to that shown in the illustrations herewith.

A double conductor waterproof cable supplies current to the lamp and is attached to a special watertight plug and fixture on the deck of a vessel, or wherever it is desirable to have the terminals of the lighting circuit.

In operation, the light is lowered into the water and the current turned

on. The whole lamp weighs, when submerged, a trifle more than its own bulk of water, and may remain suspended or can be carried about at will by the diver.

Suitable arrangements are provided whereby the diver can, by simply moving a handle, spread the light equally on all sides or concentrate it in some particular direction.

The value of the concentrated beam is evident when it is desired to examine minutely an injury to a ship's hull. It is also of great advantage in photography under water, a subject which has heretofore received very little attention.

In conjunction with this powerful light the camera plays an important part in reproducing a perfectly truthful likeness of what actually exists at depths where the professional diver or engineer may not care to go. Such a record serves to insure a perfect understanding between the diver and those in charge of a work.

Photographs of the battle-ship "Maine" as she lay on the bottom of Havana Harbor would have been infinitely more satisfactory to the investigating board and the public than any opinion from the divers, who declared that they could distinguish very little on account of the foulness of the water and general confusion of the débris. It was clearly hazardous to base any part of a decision upon the sense of touch alone.

The lamp comprises a heavy glass globe, of suitable thickness to withstand deep sea pressures as well as internal gas pressures; a cap fitted to it and the joint made water-tight by means of rubber gaskets; and a chamber containing the regulating or feed mechanism. The feed wires are led into the lamp by a cable passing through stuffing boxes and protected from being bent abruptly by a coil of steel wire. By a special device the heat and gases of combustion are kept from entering the mechanism chamber and destroying the solenoid and other apparatus for regulating the feed of the carbons.

By means of thumb screws the lamp may be quickly opened and recarbonned. The lamps will burn for 150 hours on one set of carbons.

When the lamp is burned in air the excess of heated gases of combustion and the internal pressure attendant thereon are relieved through a check valve, and also when the lamp is used under water at shallow depths. When the lamp is immersed to greater depths, the pressure within the lamp is equalized by the external pressure by the water, and the lamp is at equilibrium inside and out. A lamp thus constructed will burn for any desirable length of time, limited, of course, by the life of the carbons. An arc of very high candle-power may be used, thus lighting up a large area and enabling divers and other marine investigators to carry on their work with greater facility than heretofore. Although especially designed and adapted for submarine lighting, this lamp may be used in the atmosphere with equally good results.

The uses to which a lamp of this

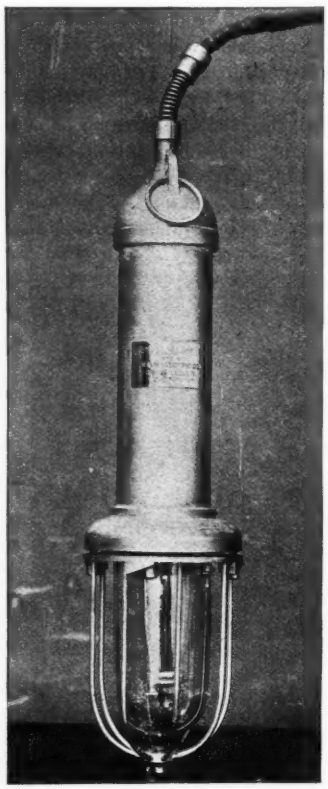

FIG. 2.—A SUBMARINE ARC LAMP.

design may be put are many and varied and will occur to those interested in marine and naval matters. Among the possibilities mentioned are examining and cleaning the bottoms of merchant and battle-ships, attaching hoisting chains to guns and other movable parts on sunken vessels, placing and recovering submarine mines, constructing bridge piers, coffer dams and in photography.

Fifty bonds of the Parsons Light and Heat Company, of Parsons, Kas., held by the Travelers Insurance Company as security on a loan to the Parsons company of $40,000, have been sold to President Batterson, of the Travelers, for his company for $12,000. The bonds are for $1,000 each, and bear interest at six per cent.

Franklin Institute Lectures.

The programme of lectures to be delivered during the season of 1898 and 1899 before the Franklin Institute, of Philadelphia, includes the following:

Tuesday, October 25, 1898, Mr. A. J. Wurts, Pittsburgh, Pa., on "Lightning and Lightning Arresters."

Tuesday, November 8, 1898, Mr. J. F. Stevens, Philadelphia, on "Concerning Electrical Instruments."

Friday, February 10, 1899, Mr. T. Commerford Martin, on "Electric Power Transmission."

Tuesday, February 14, 1899, Mr. Albert B. Herrick, New York, on "The Electric Inspection of Street Car Equipments."

Friday, February 17, 1899, Prof. Arthur W. Goodspeed, on "Latest Development in the X Rays and Their Application."

Tuesday, February 28, 1899, Mr. Edward E. Higgins, on "Some of the Larger Transportation Problems in Cities."

Tuesday, March 28, 1899, Mr. B. C. Washington, Jr., on "Water-Power Electric Plants in the United States."

Tuesday, April 25, 1899, Prof. Reginald A. Fessenden, on "Electro-Magnetic Mechanism, Design of, with Especial Reference to High Frequency Telegraphic Receivers."

Tuesday, May 23, 1899, Mr. James Hamblet, on "Electrical Clocks Historically Considered, with a Description of the Most Successful Applications of Electricity to Clocks and the Uniform Distribution of Time."

The Telephone in the Schoolroom.

The State Normal School at River Falls, Wis., has been equipped with a complete telephone and electric programme clock system. The work was done by the Julius Andrae & Sons Company, of Milwaukee, and is said to work in a highly satisfactory manner. The clock works automatically, announcing the exact time of new studies for the various classes, as well as indicating the department in which they will be held. In the superintendent's office is a switchboard which enables him to communicate by telephone with any department of the large school without leaving his desk.

Jernegan Home Again?

According to a letter received from Brussels by his father, the Rev. P. F. Jernegan, president of the Electrolytic Marine Salts Company, is contemplating a return to this country, surrendering himself and all his property to directors of the defunct company and standing for whatever punishment his actions have made him liable. A bill has been filed in the Supreme Judicial Court for a receiver for the Electrolytic Marine Salts Company.

ROENTGEN-LIGHT NOTES.

BY WILLIAM ROLLINS.

NOTE XXIX—ON HARMONY BETWEEN TUBES AND GENERATORS.

The maker of a tube should know the form of the generator by which it is to be excited, and when, after trial, they are found to be in tune, the tube should never be used on any other generator.

For example, if a tube is adjusted to give good results with a static machine of eight plates, 28 inches in diameter, run at a speed of 200 revolutions a minute, a common type and speed, and is then excited by an eight-inch coil with a 10 microfarad condenser, the current being broken 1,200 times a minute, also a common type and speed, the tube will be useless in a few minutes because the vacuum has been lowered. If we continue the excitement of the tube until some hours after the vacuum has risen sufficiently to admit of the production of radiant energy of suitable wave-length, we shall find, on exciting the tube on a properly arranged alternating-current dynamo, that in a few minutes the vacuum has again fallen, while the wave-length of the radiation has increased until it produces chiefly ordinary light; the waves are too long to go through the tissues of the body without being scattered.*

The cause of these changes is increased amperage, and this is one explanation of the phenomena to be mentioned in note 34. On the other hand, increased electro-motive force will produce the same result. If we take a tube which is in perfection for the static machine already mentioned and excite it with one having plates four feet in diameter and use a slow speed and a less number of plates so as to prevent increasing the amperage, we shall find in a few minutes that the vacuum has fallen so much that several hours' running will be required to bring it up. When it has risen to the proper point again, if we place it on a machine with six-foot plates, taking the same precautions with the amperage as before, we shall get the same result. Now, if we use both increased amperage and electro-motive force, we can, in a few seconds, bring down the vacuum so that eight hours' running on this large machine will be needed to bring it up to the proper degree. With a powerful Tesla high-frequency coil it is possible to quickly bring up the vacuum, because the amount of force which can be sent

* Note x, *Electrical Review*, January 5, 1898.

through a tube with one of these generators in a short time is enormous in comparison with what can be obtained from even a large static machine. On this account Tesla coils must always be used for photographic work where attempts are made to get instantaneous views of the heart, but as the light is at present less steady, and as they raise the vacuum so rapidly, they are less satisfactory for visual work than large static machines, which, sending the surges less frequently, still give light enough to see properly, and using less amperage in a given time, raise the vacuum less rapidly and require less attention when run continuously.

I have occupied more space in describing this matter than has been taken for much more important observations on account of its immediate practical bearing. Operators are much annoyed by the working of new tubes, and tube-makers are blamed unjustly. At present, when an order is given for

FIG. 40.—MODIFIED FOCUS TUBE.

a tube the electro-motive force and amperage of the generator on which it is to be used should be given. On the other hand, for the future, tube-makers should be provided with generators having higher electro-motive force and greater amperage than any other on which the tubes are afterward to be used, otherwise they will continue to spend hours in vain attempts to get their tubes high enough so they will not fall when their customers use more powerful generators. The correct way to pump a tube is to first exhaust it with a mechanical pump, then with an automatic mercurial pump, keeping the tube hot, and from time to time for a minute sending through it a stronger current with a higher electro-motive than will ever be used on it afterward; the object being to force into the circulation all the particles from the terminals and walls.

I am not sure we know all the causes for the fall in a vacuum, but some of my experiments have shown that some of the particles of gas which are forced into the circulation come from the terminals, because, if these are kept as near the freezing point as possible by means of my cooled terminals a longer time, a higher electro-motive force or a greater amperage will be required to lower the vacuum. Keeping down the temperature of a tube also retards the breaking of the stress molecules which are formed as stated in note 24, and this also delays the lowering of the vacuum.

NOTE XXXVIII — ROENTGEN-LIGHT TUBES IN SPECTRUM ANALYSIS.

In note 30 it was stated that the wave length of the radiant energy

FIG. 38.—FOCUS TUBE

FIG. 39 —FOCUS TUBE.

whose manifestations were discovered by Lenard and Roentgen, depended upon the temperature to which the originating particles were raised. In other words, we are here dealing with cosmic intensities. The very obvious bearing of this observation on spectrum analysis is now mentioned. By means of a focus tube I have found the spectrum of a substance to be primarily a function of the temperature of the originating particles, and have been able to extend my knowledge of a few gaseous spectra beyond what was practical with the usual types of tubes, of which two figures are here given. To be certain these were typical, Fig. 38 was taken from an article by Michelson, On Radiation in a Magnetic Field, *Philosophical Magazine*, April, 1898, and Fig. 39 was copied from a tube at present in use by Lyman in his investigations of short waves. With either a strong current melts the capillary portion. By making the tube of the form shown in Fig. 40, this objection

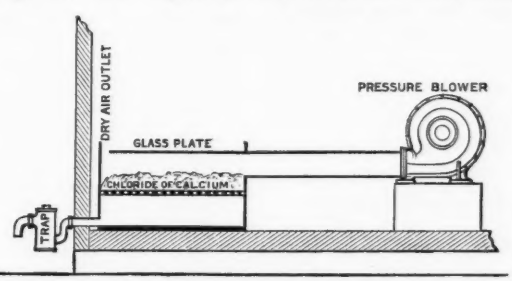

FIG. 41.—ARRANGEMENT FOR CIRCULATING AIR OVER CHLORIDE OF CALCIUM.

is overcome, while by carefully adjusting the terminals, which for this purpose may be movable, as in some of the focus tubes shown in previous notes, we can maintain the temperature of the particles at the focus at a higher range than in the two previous ones without injury to the tube. Neither of these three forms is suitable for studying spectra at the highest attainable temperature, a reflecting focus tube being required for this purpose for the reasons given in notes 30 and 35. I do not, however, recommend a focus tube of any type for visual examinations, nor as a substitute for the usual forms, but as supplementary to them for photographic work.

NOTE XXXIX—ON SOME ADVANTAGES OF HIGH ELECTRO-MOTIVE FORCE.

For part of my experiments I have used a comparatively high electro-motive force, not, however, so high as that employed by Trowbridge and Burbank, for none other than Great Jove has such potentials at his command. One of my generators contains eight revolving glass plates, each six feet, and eight stationary plates, each six and one-half feet in diameter. With this apparatus, which supplies a constant stream of electricity for any number of hours, it is practical to produce radiant energy of the wave-length required for the manifestation of Roentgen light with a vacuum so low as to be equal in resistance to only one-sixteenth of an inch of air on this generator.* This is a distinct advantage, because it is easier for the makers to furnish tubes with low than with higher vacua, while, by beginning with a low vacuum and a long spark-gap in series with the tube, we have longer working periods between adjustments of the vacuum with the oxygen regulator, for it is only necessary to shorten the spark-gap, as the resistance of the tube rises, to keep the character of the radiation constant. On these and other accounts I recommend generators of high electro-motive force for hospitals and office use, where portability is not important.

NOTE XL—ON STATIC MACHINES AND HUMIDITY.

Summer is a trying time for users of static machines, for there are many days when the air contains eight grains of water to a cubic foot. Under these conditions static machines, even when in (what are considered) tight cases, do not work with full power, and frequently reverse. This being the only defect of this type of generator for producing the current to excite a Roentgen-light tube, it may be well to call attention to a simple method of obviating it. The usual method is to have a dish of chloride of calcium or of sulphuric acid in the case to absorb the moisture. With large machines this is not effective, on account of the large volume of air and slow circulation. Where there are several hundred cubic feet of air in a case, it is essential to success to maintain a circulation of the air over the chloride of calcium or other drying substance. Fig. 41 shows a simple arrangement. It consists of a Sturtevant pressure blower to the outlet of which is attached a wood tube connecting it with a box containing chloride of calcium, over which the air must pass before it can escape. The liquefied salt drips through the perforated shelf and escapes from the case, air being prevented from entering by means of a trap. The shaft of the blower extends through the walls of the case, a stuffing-box preventing air from entering. The blower should be belted to the motor to avoid a ground. Provided with this apparatus there is no degree of moisture ever attained in this climate when a static machine will not work with full power in a few minutes after the fan is started.

*Note xxxiv.

ITEMS OF INTEREST.

The Naragansett Electric Lighting Company, of Providence, R. I., has decided to increase its capital stock from $1,200,000 to $2,000,000.

At a recent meeting, the City Council of Monroe, La., adopted a resolution giving authority to the Mayor to employ competent engineers and architects to furnish plans for a combined waterworks and electric light plant.

The Edison Electric Illuminating Company of Boston, at its annual meeting on October 11, re-elected its board of directors, with the exception that William Powell Mason succeeds E. F. Whitney. The officers were re-elected.

The Lombard Water-Wheel Governor Company, 61 Hampshire street, Boston, Mass., has just issued "Catalogue B," which contains, besides illustrations and full descriptions of its various types of water-wheel and steam-engine governors, a great deal of valuable data taken from actual practice. This information is presented in a condensed form, and is of the kind most valuable to those interested in speed regulation of water-wheels and steam engines. The catalogue may be had on application.

Effect of War on the Telegraph Business.

[*From the Wall Street Journal.*]

The annual report of Western Union failed to show a decrease in the cost per message. There was good reason for this in the fact that the government and press service afforded less than the average profit. It was, nevertheless, something of a trial to friends of the company that the average cost per message should be the highest reported for 13 years, while the average receipts per message were the lowest in the history of the company. Western Union is confronted with the problem which has confronted railway managers in recent years. Competition is steadily bringing down the average returns. The public demand for varied and expeditious service not only prevents the lowering of cost but has actually resulted in a considerable advance in cost since 1892.

Going back 20 years, we find that in 1878 the average receipts per message were 38.9 and the average cost 25 cents. The average receipts last year were 30.1 cents and the average cost 24.7 cents. The low point in cost was in 1892, when the outlay per message was 22.3 with the average income 31.6. As one cent per message means on the basis of last year's business $621,737, the difference in cost between the low rate of 22.3 in 1892 and the cost last year of 24.7 amounts to over $1,500,000 in net profits.

Add a cent and a half more as the difference in average receipts and it will be seen that the Western Union company was nearly $2,500,000 worse off last year than it would have been could it have had the rates and the cost which prevailed in 1892 on the volume of business transacted in 1898. Even taking the volume of business of 1897, the results would have made an important difference in the surplus over dividends. The number of messages in 1897 was 58,151,684, while last year the number of messages was 62,173,749. These additional 4,000,000 messages were accompanied by an increase in profits of only about $358,000, confirming fully the language of the annual report to the effect that on the increased business the tolls were the lowest, although the highest grade of operating service had to be employed for their efficient transmission.

Electrical Development in China.

[*From the New York Commercial.*]

Electricity is at last to invade the domain of the Emperor of China. All efforts that have heretofore been made by Americans to give the Chinese some of the advantages that our country enjoys have been repulsed, for the superstitious Mongolian refused to accept anything that seemed so mysterious as the current which could not be seen, but which accomplished such startling results.

For some months past representatives of the Chinese Government have been in this country studying the uses of electricity, with the result that a recommendation was made for its adoption in a woolen mill being erected at Tien-Tsin. The contract has been awarded to a Pittsburgh firm for the manufacture of all the necessary dynamos and other appliances, and within a few months the plant will be in operation.

The invasion of China by American machinery, and particularly by electrical appliances, marks an epoch in the American manufacturing world. England and Germany have made great efforts in this same direction, but have accomplished no results. It remained for the Chinese themselves, after its superiority had been fully demonstrated, to select the American product. The field opened up now is an almost inexhaustible one. China needs many other things to put it on anything like an equal footing with other nations, so far as modern improvements are concerned. The locomotives, cars and appliances for many miles of new railroads are to be supplied by this country, and already Pittsburgh and Chicago mills are busy turning them out.

It is a compliment of the highest degree to the American manufacturers to have their material selected for use in the Orient. Now that an opening has been secured, other orders for all kinds of manufactured goods will follow rapidly, until China will look to America for her supplies as she looks to no other country.

A New Telephone Catalogue.

The Electric Appliance Company, of Chicago, has issued catalogue No. 14, which thoroughly illustrates and describes the telephone apparatus and construction material carried in stock by this well known supply house. A complete system of trade numbers and telegraph code words is incorporated in the catalogue for the convenience of customers who wish to place orders by wire. The catalogue covers every detail of the telephone exchange and line from a switchboard to a pair of climbing irons. It is one of the most complete of its kind that the ELECTRICAL REVIEW has seen.

THE PHOTOMETRY OF THE ENCLOSED ALTERNATING ARC.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, SEPTEMBER 28, 1898, BY CHARLES P. MATTHEWS, W. H. THOMPSON AND J. E. HILBISH.

(*Concluded from page 229.*)

Lamp C—This lamp was provided with an outer spherical globe of milky glass. The data obtained for the distribution of intensity were as follows:

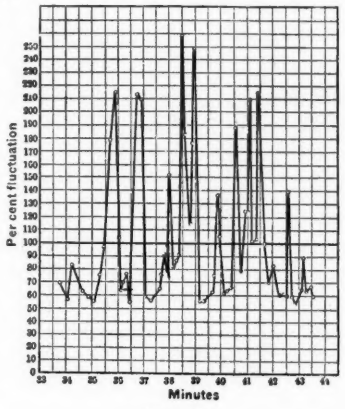

FIG. 10.

TABLE VI.

Angle Degrees.		Without Globe. H. U.	With Globe. H. U.
0	horizontal	132.0	37.2
10	above	137.0	42.8
20	"	158.0	42.7
30	"	122.0	38.4
40	"	85 0	28.7
50	"	30.4	17.4
60	"	18.0	7.7
10	below	126.0	36.1
20	"	133.8	32.6
30	"	140.7	31.4
40	"	117.0	30.0
50	"	120.0	28.2
60	"	90.0	30.7
70	"	68.0	29.3
80	"	47.5	24.7

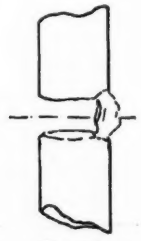

FIG. 11.

The foregoing values are plotted in Fig. 8. This distribution is in some respects anomalous. The larger area below the horizontal is due to the presence of a narrow reflector placed inside the outer globe. No reliable reason can be given for the presence of the maximum at 20 degrees above. It may be due to some lack of accurate centering of the carbons. The peculiar shortening of the radii of the inner curve in the lower angles, baffled the observers for some time. It was finally found that the milky glass of the outer globe was much more dense in the lower hemisphere than in the upper, and the absorption was correspondingly greater.

It should be said in connection with the inner curve that the amount of light cut off was in reality not so great as the figure indicates. The dispersion is so great, with a globe of milky glass, that the globe plays a strong part as a radiant. Now, the mirror used was not sufficiently large to furnish rays on the photometer disk from all parts of the globe, and hence the lamp was not given quite full credit for what it was doing.

The results of the test of this lamp may be summarized as follows:

TABLE VII.

Volts	110 0
Amperes	7.0
Apparent watts	770.0
True watts	484.0
Watts in mechanism	116.0
Power factor	0.63
Maximum intensity	158 0
Mean hemispherical intensity:	
Upper hemisphere	68.5
Lower hemisphere	99.0
Mean spherical intensity	83.8
Watts per mean spherical, Hefner units	5.76
Watts in arc	364.0
Watts in arc per mean spherical, Hefner units	4.34
Globes, character of	opalescent inner.
Carbons	"Electra."

In the course of the measurements on this lamp, the terminal electromotive force was varied between the limits of 87 and 118 volts, and readings of intensity, power and current taken for each step. The results are plotted in Fig. 9. It will be noted that the power increases directly as the voltage; while the intensity is a rapidly increasing function of the voltage. The change in the current is slight. The high intensity at high voltage is partly due to the longer arc, but more especially to the higher temperature of the carbon points and consequent increased surface in the craters.

In Fig. 10 are shown the fluctuations in intensity which occur in the enclosed alternating arc. With the recording device already described, it is possible to get settings of fair accuracy with a considerable degree of rapidity, as is here shown. The large changes in intensity are plainly noticeable in watching the arc, but the eye does not furnish an estimation of them comparable with that to be gained from the curves, for the psychophysical reason already referred to. It will be noted that the higher values shown in Fig. 10 are of more infrequent occurrence than the lower values. Indeed, it is only when the arc is towards the photometer and flaring out in the manner shown in Fig. 11, so that both craters are inclined towards the disk, that these extreme values are obtained, and then they last but an instant. For all other positions of the arc, whether on the sides or on the back, only the lower values are obtained.

Two causes, it was thought, might contribute to these fluctuations; namely, the changing length of the arc and the "wandering" character of it. To test this, the curve in Fig. 12 was taken with a fixed length of arc, the clutch being entirely out of action. The result plainly shows that the chief cause of the fluctuations is the hunting of the arc. While the intensity varies with the length of the arc, the motion of the

carbons is so slight, in a well regulated lamp, that it plays little, if any, part in causing the variations shown.

COMPARISON WITH THE ENCLOSED DIRECT-CURRENT ARC.

Lamp D — Measurements were made on a direct current lamp of the same manufacture as lamp A, with a view of bringing this type of lamp under conditions identical with those of the tests of the alternating arc. The lamp was fitted with an opalescent globe only. The distribution of intensity is as follows:

TABLE VIII.

Angle. Degrees.	Intensity. H. U.
0 horizontal	218
10 above	165
20 "	237
30 "	159
40 "	144
50 "	121
60 "	60
10 below	410
20 "	391
30 "	341
40 "	377
50 "	369
60 "	416
70 "	172
80 "	106

In Fig. 13, these values will be found plotted in the usual manner. This curve was taken with great care, and may be taken as typical of the distribution due to the enclosed arc fed by a direct current. The peak at 20 degrees above is due to the small crater of the negative carbon. Here, also, the depression in the curve, due to the low luminosity of the arc, is found displaced by 10 degrees above the horizontal. This lamp will give an excellent illumination at points somewhat remote, because the curve is so full in the region just below the horizontal. A shade would still further improve the lamp in this respect. Detailed results are given in the following table:

TABLE IX.

Volts	108
Amperes	4 96
Watts	536
Watts in mechanism	152
Maximum intensity	416
Mean hemispherical intensity:	
Upper hemisphere	106 5
Lower hemisphere	288
Mean spherical intensity	197.3
Watts per mean spherical Hefner unit	2.72
Watts in arc	384
Watts in arc per mean spherical Hefner unit.	1.95
Globes	opalescent inner.
Carbons	"Electra."

As regards efficiency, or, better, economy, say in watts per Hefner unit, the direct-current lamp is superior to its alternating-current competitor. The performance of lamp A was the best found in these tests, that of lamp C the worst. The other lamps tested showed different degrees of economy lying between the limits set by these two.

The writers feel justified in saying that the lamps of low economy could, by improvement in mechanism, be brought to a performance equal to that of lamp A. All the lamps tested, with one exception, were furnished with the same brand of carbons. With similar carbons and similar globes, a difference in economy must be attributed largely to the mechanism.

If the alternating arc be regarded apart from any regulating device, the physical reasons for its poorer qualities as a light source are to be found in the lower temperature of the glowing points and in the diminished area of crater surface. In the direct-current arc we find two bright surfaces of unequal area and of widely different temperature. In the alternating-current arc we find two bright surfaces of the same area and of the same temperature. According to Rossetti, the temperatures in the first case are 3,900 centigrade and 2,700 centigrade. Now the points in the alternating arc are as much positive as negative, and hence, whatever the unknown law connecting the temperature of glowing carbon with the intensity of the light due to it, we should expect the mean spherical intensity of the alternating arc to have a value intermediate between the values of mean hemispherical intensity for the upper and lower lobes of the distribution due to the direct-current arc. A comparison of lamps A and D shows this point, although the total power is not the same. If the power consumption of the alternating arc were raised from 327 to 384, it is very probable that the mean intensity would be found raised from 110.5 to a considerably higher intermediate value.

The values of the intensity of the direct-current lamp are lower than those found by some earlier observers. In fact, the enclosed arc has been reported in some instances as quite equal to the average open arc. It is difficult to see how these results can be accurate for a lamp fitted with an opalescent globe. The results of a test recently reported by Nichols agree closely with those given for the direct-current lamp in this paper.

Electrical Laboratory, Purdue University, Lafayette, Ind., September, 1898.

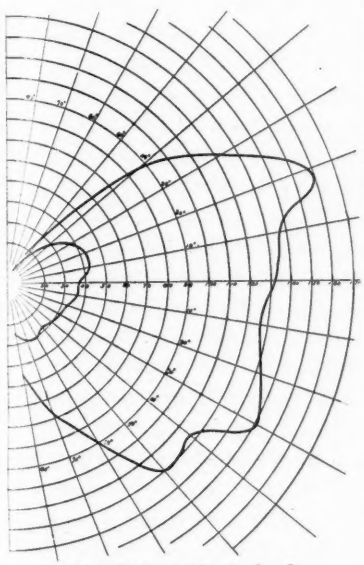

Fig. 8.—Distribution of Intensity. Lamp C.

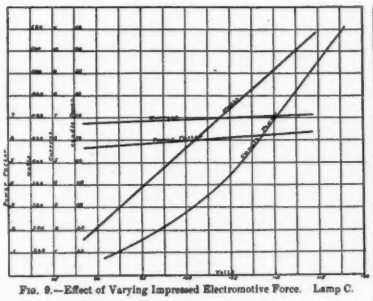

Fig. 9.—Effect of Varying Impressed Electromotive Force. Lamp C.

FLUCTUATIONS IN THE INTENSITY.

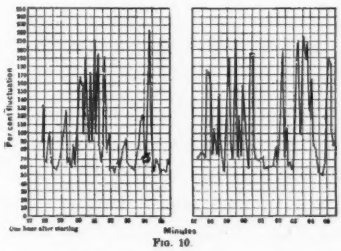

Fig. 10.

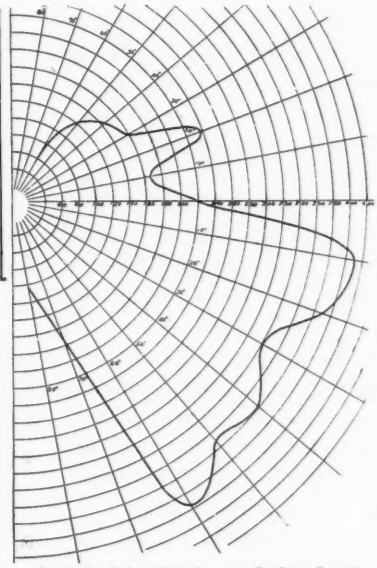

Fig. 13.—Distribution of Intensity. Lamp D. (Direct Current.)

DIAGRAMS ILLUSTRATING "THE PHOTOMETRY OF THE ENCLOSED ARC LAMP."

ELECTRIC RAILWAY NOTES.

The Brooklyn City Railway Company, of Brooklyn, N. Y., has declared a quarterly dividend of two and one-half per cent, payable October 15.

It is reported from Salem, Mass, that a syndicate of capitalists is negotiating for the purchase of a number of electric railroads in New England.

The controlling interest in the Rockland & Abington, Mass., Street Railway Company has been bought by Pepper and Register, representing a Philadelphia syndicate.

The Pittsburg, Frontenac & Suburban Railway Company, of Pittsburg, Kas., has gone into the hands of John Tracy, receiver. The suit was brought by the Guarantee Title and Trust Company, of Philadelphia.

The Cayadutta Electric Railroad Company, of Gloversville, N. Y., has elected the following officers: President, J. L. Hees, Fonda; first vice-president, Thomas Ricketts, Johnstown; second vice-president, A. J. Zimmer, Gloversville; secretary and treasurer, George M. Place, Gloversville.

At the annual meeting of the Moundsville, Benwood & Wheeling, W. Va., Electric Line the following directors were elected for the ensuing year: Messrs. McCormick and Morrison, of Sistersville; B. F. Peabody, Glendale; M. F. Cox, Moundsville; J. A. Miller, W. A. Wilson and Mr. Holliday, of Wheeling.

The Schuylkill Valley, Pa., Traction Company has organized by electing the following officers: President, C. D. Beebe; directors, C. D. Beebe, N. H. Larzelere, R. N. Douglass, Thomas Corday, D. B. Shep, H. S. Holden and G. B. Leonard; general manager, secretary and treasurer, R. M. Douglass; superintendent and electrician, A. G. Davids.

Judge Colt, of the United States Circuit Court, at Boston, has appointed W. P. Clark, of Peabody, receiver for the Newburyport & Amesbury, Mass., Horse Railroad Company. The application was made by the Mechanics' Savings Bank, of Providence, which holds $25,000 of the bonds of the company. The total issue of bonds is $350,000, and interest on them was defaulted September 1.

Twenty firemen in the employ of the Staten Island, N. Y., Electric Company struck on October 11 for a reduction in the hours of labor. The company furnishes power to the Staten Island Electric Railroad and to various factories in different parts of Staten Island. The men went out at the moment that traffic became heavy. The company yielded to their demands in three hours and the men returned to work at once.

The regular report of the Poughkeepsie City & Wappinger's Falls, N. Y., Electric Railway Company for the year ended June 30 shows: Gross earnings, $80,998.15; operating expenses, $49,540.03; net earnings, $35,458.12; gross income, $35,458.12; fixed charges, $22,839.87; net income, $12,618.25. The general balance sheet shows assets of $1,114,830.71, including $1,107,512.85 for cost of road and equipment, $4,762.86 cash on hand. The liabilities include $750,000 capital stock, $358,000 funded debt and $1,105.71 profit and loss.

Electrical Review

[OLDEST ELECTRICAL WEEKLY IN THE UNITED STATES.]

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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The electrical industry is beginning an era of good business which promises to be exceptional. Many manufacturers will be compelled to enlarge their facilities if the present run of orders continues.

CHANGES IN PATENT-OFFICE PRACTICE.

The United States Patent Office has made a notable improvement in examinations under Commissioner Duell. During the last session of Congress he had introduced a bill to provide for enlarging the force of the Patent Office, and since its adoption has brought the work of the office to an advanced stage. It is expected that the work of the office will be so far advanced by July next that action may be taken on applications within six weeks from the time of filing; and Commissioner Duell expects to shorten that time as the new system becomes perfected. Examiners who were six months behind begin to see the end of their lists; 2,896 less applications are now waiting action than was the case when the additional force was included in the Patent-Office staff.

It is now proposed to revise the patent laws during the coming session of Congress. The President has appointed a commission consisting of Assistant Commissioner Greeley, Mr. Francis Forbes, a patent attorney of New York, and Judge Grosscup, of Chicago, who are now in session in the latter city. These gentlemen will make a report indicating the proposed changes in the laws and the report will be submitted to the next Congress. The proper management of the Patent Office is of so much importance to the electrical companies that any changes in the laws directly concerns them, and they will no doubt follow the action of the committee and of Congress with great interest.

THE SLOT TELEPHONE IN CHICAGO.

The corporation counsel of Chicago has rendered an opinion that the slot-machine telephone, as used by the Chicago Telephone Company, is illegal. The opinion was sent to the judiciary committee of the city council in reply to a resolution introduced over a year ago calling for an investigation of the slot-machine telephone system. At that time, the then corporation counsel considered the matter and decided that the city had no power to prevent the use of slot telephones where patrons asked for them. The judiciary committee never took any definite action in the matter, and it was laid over at every meeting. Several weeks ago, however, the subject was again referred to the law department for an opinion. The ruling just made reverses the opinion rendered a year ago. The gist of the latest opinion seems to be that the rates now for slot-telephone messages do not conform to a schedule of rates filed by the telephone company when its franchise was granted in 1889. The city fathers of Chicago have made themselves famous for many things, and this is another.

ANOTHER NEW YORK TELEPHONE COMPANY INCORPORATED.

Another telephone company, with large capital, has been organized, apparently, to operate an exchange in New York city. A number of excellent gentlemen are named as directors. There are several places in the United States where there is a demand for improved and additional telephone service, but Greater New York is not one of them. We dare predict that the "eight per cent cumulative dividend," proposed by these incorporators, will be a long time accumulating in this city. There is no telephone service in the world that excels in efficiency and comparative cheapness that of New York city, and this is said advisedly and without the slightest prejudice.

MR. TESLA'S NEW CIRCUIT CONTROLLER.

Unusual interest attends all of the work of Mr. Nikola Tesla, but more particularly that in connection with his system of vacuum tube lighting. On another page we present a description of an electric circuit controller, one form of a series of developments in this line for which patents were recently issued to him, several of which were previously noted in the ELECTRICAL REVIEW. This invention seems to us to possess mechanical efficiency of a high order, and, like the author's work in general, marks an advanced step, and will undoubtedly possess a wide field of usefulness.

WALL STREET AND THE ELECTRICAL STOCK MARKET.

The financial situation during the past week developed considerable strength, and the outlook in general is now most encouraging. The trade of the country as a whole shows a large and well sustained volume of business. The stock market during the week has been generally strong, though a slight falling off in prices was apparent toward the close. On the New York Stock Exchange, General Electric closed at 78¾ bid and 79½ asked, a loss of 1¼ points for the week. The Edison Illuminating of New York closed at 121 bid, an advance of one point. Western Union closed the week at 91⅜ bid and 91½ asked, a loss of ¼ point. On the Boston Exchange, American Bell Telephone closed at 276 bid. On the Philadelphia Exchange, Electric Storage Battery closed at 37¾ bid and 38¼ asked.

The earnings of the Chicago Edison company for the six months ended September 30 show that the gross increased 20 per cent, and that the net earnings over fixed charges increased 11 to 12 per cent.

No stocks listed on the Boston Stock Exchange have shown greater strength than telephone shares, and they are now nearly at the highest prices they have ever sold. A Boston paper gives the highest and lowest prices of the three leading telephone stocks for 1898, and the high prices of the three previous years, with their dividend records:

	1898. High.	Low.	1897.	1896.	1895.
Bell Telephone	285	238	285	211	210
Erie Telephone	76	59	77	66¾	69¾
New England	145	120	135	103	90½

The dividend record of the above companies has been:

Bell Telephone has paid at the rate of 15 per cent since 1895, 16½ per cent in 1894, 18 per cent in 1893 and 15 per cent in 1892.

New England Telephone Company is now paying at the rate of 6 per cent per annum. In 1897 it paid 5½ per cent, 5 per cent in 1896, 4½ per cent in 1895, 4 per cent in 1894 and 3½ per cent in 1893 and 1892.

The Erie Telephone Company has paid 4 per cent in all of the above years, and the first dividend change is expected to be made by this company.

Wall Street, October 15.

Improved Circuit-Controller for Vacuum Tube Lighting and Other Purposes.

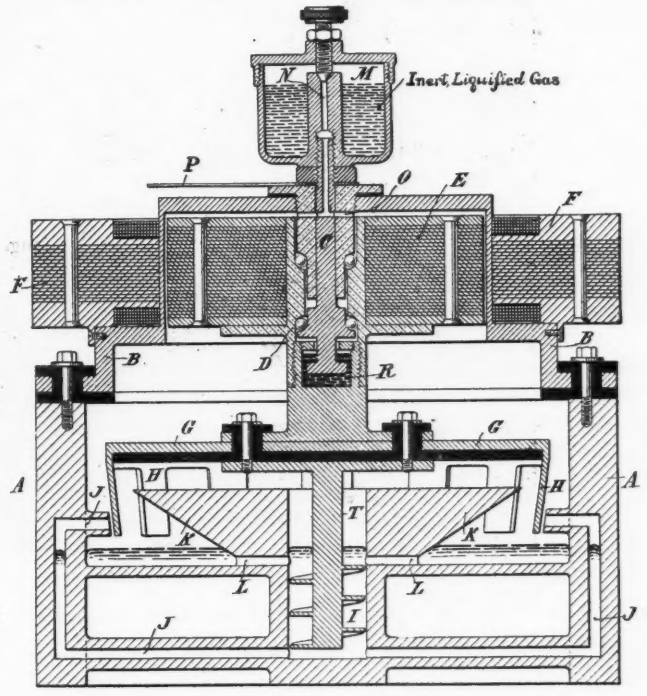
A patent was issued to Nikola Tesla October 4 relating to improvements in electric circuit controllers. The details of this invention are presented herewith, with illustration, the interesting description being in full in the language of the author, as follows:

In order to secure a more efficient working of circuit-controllers, particularly in their use in connection with my system of electrical-energy conversion by means of condenser discharges, I have devised certain novel forms of such appliances, comprising as essential elements a body of conducting fluid constituting one of the terminals, a conductor or series of conductors forming the other terminal, and means for bringing the two into rapidly-intermittent contact with each other. These devices possess many desirable qualities, particularly that of being eminently adapted for making and breaking at a very rapid rate an electric circuit and thus reducing to a minimum the time of passage of the current through an arc or path of high resistance and diminishing thereby the losses incident to the closure and interruption of the circuit. Continued experimentation with these appliances has led me to make further important improvements by causing the make-and-break to be effected in an inert medium of very high insulating power.

It is a fact, which was fully demonstrated by Poggendorff and utilized by him to improve the operation of induction-coils, that when the contact-points of a circuit-breaker are enclosed in a vessel, and the latter exhausted to a high degree, the interruption of the current is rendered more sudden, as if a condenser were connected around the break. Furthermore, my own investigations have shown that under such conditions the closure also is more sudden, and this to even a greater degree than the break, which result I attribute to the high insulating quality of the vacuous space, in consequence of which the electrodes may be brought in very close proximity before an arc can be formed between them. Obviously these facts may be utilized in connection with my novel circuit-controllers; but inasmuch as only a very moderate improvement is secured in this manner, and as the high vacuum required is quickly destroyed and can not be maintained, unless by a continuous process of rarefaction and other inconvenient measures, I have found it desirable to employ more effective and practical means to increase the efficiency of the devices in question. The measures I have adopted for this purpose have resulted from my recognition of certain ideal qualifications of the medium wherein to effect a make-and-break. These may be summed up as follows: First, the medium by which the contact-points are surrounded should have as high an insulating quality as possible, so that the terminals may be approached to an extremely short distance before the current leaps across the intervening space; second, the closing up or repair of the injured dielectric, or, in other words, the restoration of the insulating power, should be instantaneous in order to reduce to a minimum the time during which the waste principally occurs; third, the medium should be chemically inert, so as to diminish as much as possible the deterioration of the electrodes and to prevent chemical processes which might result in the development of heat, or, in general, in loss of energy; fourth, the giving way of the medium under the application of electrical pressures should not be of a yielding nature, but should be very sudden and in the nature of a crack, similar to that of a solid, such as a piece of glass when squeezed in a vice, and, fifth, most important, the medium ought to be such that the arc when formed is restricted to the smallest possible linear dimensions and is not allowed to spread or expand. As a step in the direction of these theoretical requirements I have employed in some of my circuit-controlling devices a fluid of high insulating qualities, such as liquid hydrocarbon, and caused the same to be forced, preferably with great speed, between the approaching and receding contact-points of the circuit-controller. By the use of such liquid insulator a very marked advantage was secured; but while some of the above requirements are attained in this manner, certain defects still exist, notably that due to the fact that the insulating liquid, in common with a vacuous space, though in a less degree, permits the arc to expand in length and thickness, and thus pass through all degrees of resistance and causing a more or less considerable waste of energy. To overcome this defect and to still more nearly attain the theoretical conditions required for most efficient working of the circuit-controlling devices, I have been finally led to use a fluid insulating medium subjected to great pressure.

The application of great pressure to the medium in which the make-and-break is made secures a number of specific advantages. One of these may be obviously inferred from well-established experimental facts, which demonstrate that the striking distance of an arc is approximately inversely proportional to the pressure of gaseous medium in which it occurs; but in view of the fact that in most cases occurring in practice the striking distance is very small, since the difference of potential between the electrodes is usually not more than a few hundred volts, the economical advantages resulting from the reduction of the striking distance, particularly on approach of the terminals, are not of very great practical consequence. By far the more important gain I have found to result from an effect which I have observed to follow from the action of such a medium when under pressure upon the arc—namely, that the cross-section of the latter is reduced approximately in an inverse ratio to the pressure. As under conditions in other respects the same the waste of energy in an arc is proportional to its cross-section, a very important gain in economy generally results. A feature of great practical value lies also in the fact that the insulating power of the compressed medium is not materially impaired even by considerable increase in temperature, and, furthermore, that variations of pressure between wide limits do not interfere notably with the operation of the circuit-controller, whereas such conditions are fatal drawbacks when, for instance, Poggendorff's method of insulating the terminals is used. In many other respects, however, a gas under great compression nearly fulfills the ideal requirements above mentioned, as in the sudden breaking down and quick restoration of the insulating power, and also in chemical inertness, which by proper selection of the gas is easily secured.

In carrying out my invention the medium under pressure may be produced or maintained in any proper manner, the improvement not being limited in this particular to any special means for the purpose. I prefer, however, to secure the desired result by enclosing the circuit-controller, or at least so much of the same as shall include the terminals, in a chamber or receptacle with which communicates a small reservoir containing a liquefied gas.



TESLA'S NEW CIRCUIT-CONTROLLER.

While the improvement is applicable generally to circuit-controllers, the best results will be secured by the use of devices in which a high relative speed between the terminals is obtainable, and with this special object in view I have devised a novel circuit-controller, which, though belonging to the class of which I have shown a typical form in my application for patent filed December 2, 1897, Serial No. 660,518, differs in certain particulars of construction, which will be understood from the following comparison: In the previously-described form of said circuit-controllers a rotary receptacle, carrying within it a series of spaced conductors, is driven at a high speed by a suitable motor. Mounted within and concentrically with the receptacle, but capable of free independent rotation with respect thereto, is a body which during the rotation of the receptacle is retarded or restrained against rotation by the application of a suitable force. This body carries a tube or duct, which takes up at one end a fluid conductor contained in the receptacle and rotating with the same, and discharges it from the other end against the rotating spaced conductors.

While an apparatus thus constructed is very efficient and performs the work required of it in a highly satisfactory manner, it is nevertheless subject to certain limitations, arising mainly from the amount of work which the conducting fluid is required to perform and which increases with the speed. With the object of overcoming objections that might lie to this form of circuit-controller in the particular referred to, I devised the form of instrument shown herein. The features which more particularly distinguish this form are the following: I employ a closed stationary receptacle within which is mounted a body that is capable of being rotated in any way—as, for example, by the drag or pull upon it of an external field of force or a magnet rotated bodily. The rotary body imparts rotation to a series of spaced conductors within the receptacle and also operates as a pump to maintain a flow of conducting fluid through one or more stationary ducts and from the same against the rotating conductors.

The details of this apparatus will be described by reference to the accompanying drawing, which is a vertical central section of the circuit-controller complete.

A is a receptacle, of iron, steel or other proper material, with a head B, secured by a gas-tight insulating-joint. Within this receptacle is contained the circuit-controller, which, in so far as the main feature of my present invention is concerned, may be of any desired construction, but which, for the reason stated above, is of the special character shown. A spindle C is screwed or otherwise secured centrally in the head B, and on this is mounted on antifriction-bearings a body to which rotary motion may be imparted. The construction of the device in this particular and the means for imparting rotation to the said body may be greatly varied; but a convenient means for accomplishing this is to secure to the rotary sleeve D a laminated magnetic core E and place around the portion of the head B which contains it a core F, provided with coils and constituting the primary element of a motor capable of producing a rotary field of force which will produce a rapid rotation of the secondary element or core E. To the depending end of the sleeve D is secured a conductor G, usually in the form of a disk with downwardly-extending teeth or peripheral projections H. To the sleeve or the disk G is also attached, but insulated therefrom, a shaft T having a spiral blade and extending down into a well or cylindrical recess in the bottom of the receptacle. One or more ducts or passages J lead from the bottom of this well to points near the path of the conducting teeth H, so that, by the rotation of the screw I, a conducting fluid, which runs into the well from the receptacle, will be forced up through the duct or ducts, from which it issues in a jet or jets against the rotating conductor. To facilitate this operation the well is surrounded by a flange K, containing passages L, which permit the conducting fluid to flow from the receptacle into the well, and having beveled sides, which serve as a shield to deflect the fluid expelled from the ducts through the spaces in the conductor to the bottom of the receptacle.

M is any suitable reservoir communicating with the interior of the main receptacle and containing a liquefied gas, such as ammonia, which maintains a practically inert atmosphere under pressure in the receptacle.

Preferably, though mainly as a matter of convenience, the receptacle M is a metal cup with a hollow central stem N, the opening for the passage of gas being controlled by a screw valve in the top of the cup. The said cup is screwed onto the end of the spindle C, through which is a passage O, leading into the interior of the receptacle A.

The receptacle A and the conducting fluid, which is generally mercury, being normally insulated from the head B and the parts attached and supported thereby, are connected to one part of the circuit to be controlled. The other circuit connection is made by a conductor P to any part of the head, so that when the core E and conductor G are rotated the circuit will be completed between the two insulated parts of the receptacle through the jet or jets of conducting fluid whenever they impinge upon the said conductor.

To ensure a good electrical connection between the sleeve D and the spindle C, I provide in the former a small chamber R, which contains mercury, and into this the end of the spindle C extends.

Electric Railroads in Germany.

Consul Liefeld, of Freiburg, Germany, writes that he has received a number of letters in regard to the proposed electric railway in that city, which he had described in a letter to an American journal. Consul Liefeld wrote that Freiburg was about to open bids for the construction of an electric railroad system and a central power station for electric light and for motive power, and urged United States manufacturers to compete. The technical newspapers of Great Britain have taken the action of Mr. Liefeld as a text for comment upon the energy of the United States consular service as compared with the inattention of the British consuls.

Mr. Liefeld adds that Germany is doing a great deal in the line of electric railroads at present. In a recent Berlin paper, the claim was made that there were 707 miles of electric road in Germany to 715 miles in all the rest of Europe, and that in Germany there were 2,492 electric cars, against 2,021 in all the other countries of Europe.

Third Avenue Railroad Contracts Placed.

The Third Avenue Railroad Company, of New York city, last week signed several contracts for its electrical equipment. These contracts are among the largest ever placed and are as follows: Westinghouse and Walker companies, electrical apparatus amounting to about $4,500,000; the National Conduit and Cable Company, for subways amounting to about $1,500,000; the Johnson company, about 15,000 tons of 110-pound steel rails; the Pennsylvania Iron Works, about $3,500,000 worth of castings.

It is understood that bids for the necessary underground cable have not yet been called for. Rumor has it that the alternating-current system will be used with substations, the primary voltage to be about 25,000 volts.

PERSONAL.

Mr. Arthur D. Newton, of the Eddy Electric Manufacturing Company, Hartford, Ct., visited New York city last week.

Mr. Edward H. Johnson, vice-president and general manager of the Sprague Electric Company, of New York city, will read a paper this Wednesday evening, before the Franklin Institute of Philadelphia, on "The Johnson-Lundell Surface-Contact System of Street Railway." The paper will be fully illustrated.

OUR CANADIAN LETTER.

ROSSLAND, B. C.—There is an agitation in favor of municipal ownership of electric light and waterworks systems.

PEMBROKE, ONT.—The council is obtaining information regarding the cost of installing a municipal lighting plant.

DUNDAS, ONT.—The town has given a franchise for electric lighting to a local company, of which H. Harper is manager.

SAULT STE. MARIE, ONT.—A charter for an electric railway or a steam road from this city to Michipicoten has been applied for.

YARMOUTH, N. S.—There is said to be a possibility of the Yarmouth electric railway being extended to Port Maitland next Spring.

CHATHAM, ONT.—An electric railway from Ridgetown to Rondeau Park, near this city, is one of the probabilities of the near future.

CARBERRY, MAN.—A representative of an electrical company is endeavoring to obtain from the town a franchise for electric lighting for 25 years.

LONDON, ONT.—Five tenders have been received by the town for the supply of an incandescent lighting plant, but the figures have not been made public.

PETERBORO, ONT.—The Peterboro & Ashburnham Street Railway has been sold to Arthur Stevenson. It is probable that some improvements will be made.

OTTAWA, ONT.—A company, represented by T. Lindsay, has applied to the City Council for permission to sell electric light and power within the city limits.

CAMPBELLFORD, ONT.—The ratepayers have voted in favor of raising the sum of $8,000 to install a new incandescent lighting plant to replace the one now in use.

BARRIE, ONT.—Recently the ratepayers sanctioned a by-law to raise $35,000 for the installation of a municipal electric light plant. Tenders were taken some weeks ago.

DUNDAS, ONT.—The by-law granting a franchise to the Dundas Electric Company was passed at the last council meeting. The company agree to furnish power by December 1.

HAMILTON, ONT.—Ratepayers in the district of Vineland and the township of South have asked the Hamilton, Grimsby & Beamsville directors to extend the road from Beamsville to St. Catherines.

THOROLD, ONT.—Tenders are invited for furnishing an incandescent electric light plant from 1,500 to 2,000 lights. Particulars from R. J. Parke, consulting engineer, Toronto.

DARTMOUTH, N. S.—A scheme is on foot to construct an electric railway from Waverly to this place, thence to Musquodoboit Harbor. A meeting of the promoters will be held at an early date.

HAMILTON, ONT.—The City Council has decided to extend the franchise of the street railway company for 15 years. As soon as financial arrangements are completed, some improvements will be made in the system.

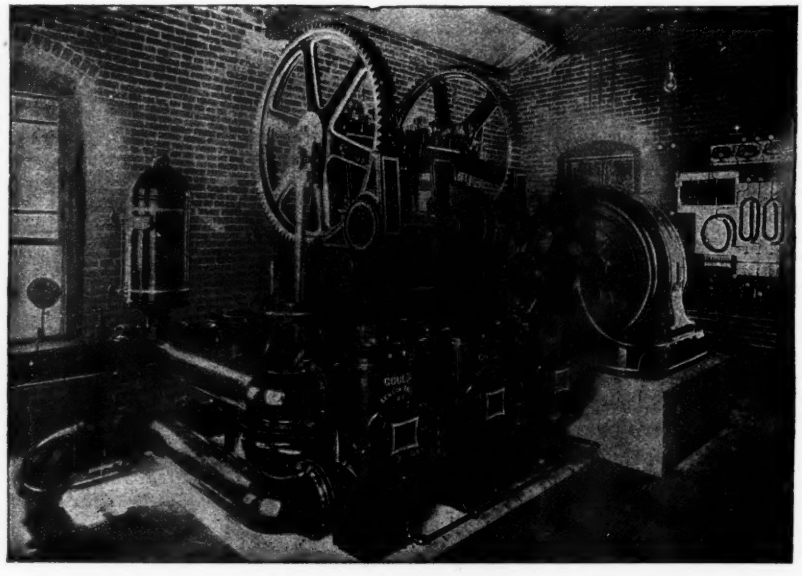
BRANTFORD, ONT.—The Paris Electric and Power Company, represented by Messrs. Carroll & Smith, have requested permission to distribute electric power in this city. The company propose utilizing the water-power of the Grand River by building a dam.

ST. CATHERINES, ONT.—Haines Brothers, of New York, who have secured the control of the Niagara Central Railway, announce their intention of operating the road by electricity. Various changes in the roadbed will be made and the trestle work at Merritton and Thorold done away with.

OTTAWA, ONT.—There is a movement on foot to secure the extension of the Ottawa Street Railway through Britannia, but it is probable that the matter will not be taken up before next Spring. The cost of the extension is placed at $125,000. It is also urged that the road should be extended to Rockland, 22 miles distance.

PETERBOROUGH, ONT.—The Peterborough Light and Power Company have requested the council to grant exemption from taxation on proposed improvements. The company intend constructing a new power-house. If the request is granted, the Dickson company will deepen their raceway. The proposition has also been submitted. that instead of building the London street bridge over the race 20 feet, the town will make it 52 feet, on condition that the Dickson company build the center pier.

Montreal, Oct. 15. J. A. C.



A GOULDS ELECTRIC FIRE-PUMP INSTALLATION.

Trolley Car Etiquette.

Trolley riding has got to be such a fad, fashion or fancy, and is so generally adopted by all classes and conditions of people, that there is a necessity for a code of etiquette, observes the Cincinnati *Commercial Tribune*. For some persons are well bred and some are not. Some think they are and are not, and they are about the most obstinate of the whole push.

The man who boards a trolley car should not labor under the delusion that paying his fare means owning the car.

He should not, if he is a big, fat man, persist in monopolizing one of the end seats of the car, making it necessary for the other passengers, who are bold enough to attempt to occupy the same row, to ignominiously crawl over him to gain a seat.

He should not carry sweitzer lightly wrapped or even unwrapped.

If he smokes he should do so with discrimination and with some regard to others. If it is a stogie he should swallow the smoke and keep it swallowed. If it's a cigarette—well, nothing is too bad for the smoker.

But this code is not intended for men alone. There are others, and the others are women mostly, though some are young girls who are not supposed to know and are not to blame.

As to a woman, no matter how comfortable the position, she should not sit with her feet resting on the railing in front of her. She should make her feet as inconspicuous as possible.

She should not talk for the benefit of the car. She should be careful that her manner is dignified and quiet.

She should avoid giggling.

She should never mistake a trolley car for an impromptu restaurant.

But why particularize. Behave yourself and be happy.

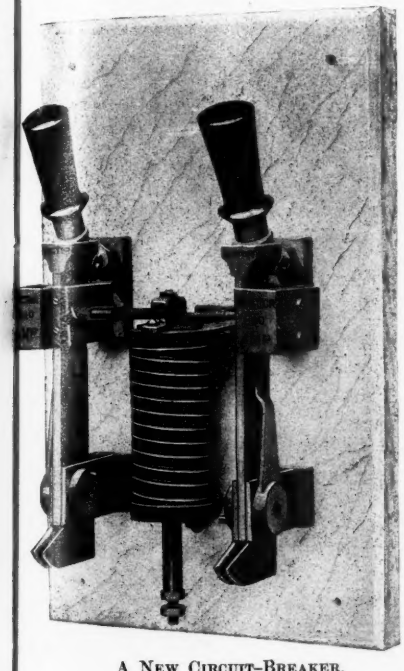
Electric Pumps for Fire Protection.

An interesting installation of electric pumps for fire protection is shown in the illustration herewith. The outfit was supplied by the Goulds Manufacturing Company, of Seneca Falls, N. Y., to the Chicago, St. Paul, Minneapolis & Omaha Railway for use in protecting from fire the railroad freight house at Itasca, Wis. In the freight station is a system of electric signals and switches by which one man can turn on the power over a mile away, start the electric pump, and get water to a fire in a few seconds. The pump is of the double-acting, triplex, Goulds form, with a capacity of 750 gallons per minute.

A New Circuit-Breaker.

Herewith is illustrated a new circuit-breaker which has been on the market for several months, and has been used on some of the largest installations in New York city. It is worthy of mention, owing to several new and novel features. The action is new and radically different from other similar instruments.

This circuit-breaker is manufactured by F. A. La Roche & Company, Thirteenth and Hudson streets, New York city, who are also the manufacturers and owners of the "Ideal" circuit-breaker. They also manufacture a full line of switches, switchboards and all kinds of automatic switching devices. The new circuit-breaker's trade name is "Victor."



A New Circuit-Breaker.

The style of this circuit-breaker is of the fly-out action, but the danger to the operator is reduced to a minimum, owing to the shortness of the blades, and the momentum being checked or broken as soon as the circuit is interrupted.

They are made of the independent action; that is to say, that each blade is separately thrown in and controlled, and in case of a short-circuit or overload, both blades simultaneously open up, the action in that respect being similar to the well known "Ideal" circuit-breaker.

Neither the "Victor" nor "Ideal" circuit-breaker can be closed as long as the overload or short circuit exists in the line. As soon as one blade is thrown in, and an attempt is made to throw the opposite blade in, the blade already in the clips will open up independently of the blade being closed, thereby making it unnecessary to use knife-switches in conjunction with these circuit-breakers.

Each blade has a separate latch and catch, which act on the roller principle, reducing the friction to a minimum, and is independently hinged on a self-locking hinge post, which, by the act of closing the blade, compresses the clips of the hinge post, and which can be compressed to any degree. This locking device is graduated and is adjustable.

It is stated that these breakers will not heat at the hinge post with double the normal amount of current passing through. The breaker is equipped with new style carbon breaks of liberal capacity, so adjusted that the blades have left the conducting clips one inch before the break takes place on the carbon, therefore preventing burning of the clips, freezing and cutting, which so often cause trouble with switches and circuit-breakers.

The solenoid is differentially wound, very little current passing through the outer coil. The coils on the circuit-breakers, from 100 amperes up, are wound with bare copper and carefully insulated, yet when the coil is completed it looks like one solid spiral of copper. The entire circuit-breaker is made up of cold, hard-drawn copper, no castings being used. Each blade has an independent plunger and copper-steel spring which can be removed, if required, from the front or back of the board, as may be desired.

Another advantage of this circuit-breaker is the few number of holes that need be drilled in the switchboard, only seven holes being required to hold the circuit-breaker in place and on the board. The range of adjustment is large; namely, a circuit-breaker with a normal rating of 200 amperes can be adjusted to break a circuit anywhere between 100 amperes and 400 amperes. They are also made with underload attachment. All these circuit-breakers are carefully and accurately calibrated.

Edison Electric Illuminating Company of Boston.

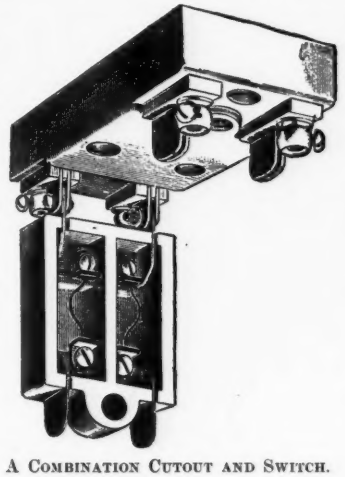
At the last annual meeting of the Edison Electric Illuminating Company of Boston, held February 1, it was voted to change the company's fiscal year to end June 30 instead of December 31. President Rogers, in a report covering operations for the six months ended June 30 last, says: "The first, second and third stations of the company are now equipped not only with steam plants, but with storage batteries, while the fourth and fifth stations are equipped with storage batteries only. With the completion of this last station, the company now has the largest storage battery installation in the world." Earnings for the six months were: Gross, $488,964; operating expenses, $306,851; net earnings, $182,113. Lamps and motors connected, as of date June 30, compare:

	1898.	1897.	1896.
Incandescent lamps	161,4 6	138,682	114,354
Arc lamps	1,486	1,446	1,112
Motors, horse-power	6,473	5,675	5,131

A Combination Cutout and Switch.

In the illustration herewith is shown a combination cutout and switch which is being extensively used in connection with enclosed arc lamp installations, as well as for other services where a device of this kind is applicable. It is manufactured by J. C. Fagan, 3 Arcade, Watertown, N. Y.

The cutout is designed to be attached to the ceiling to take the place of the ordinary main line cutout, as well as the double-pole switch, such as is required by the insurance underwriters at the entrance to buildings. As the wires come into the building, they are run directly to the cutout and from the cutout straight to the lamps, without being carried down the side wall, in the usual manner, to reach the switch. Thus a saving is effected in cleats, wire, extra switch, and labor.



A Combination Cutout and Switch.

The Fagan combination cutout and switch is opened and closed by means of a cord passed through a hole in the cover, with a knot tied tightly on each inside, one end passing up through a hole in the base and along a groove to the back end. The cord hangs down within easy reach of the floor. The other end of the cord hangs down the same length, and by pulling one or the other the lights are turned on or off, as desired. An important advantage of the device is that the current is entirely cut off from the fuse terminals when refusing is necessary.

ELECTRIC LIGHT FLASHES.

The La Grande, Ore, electric light plant has been sold under execution in the United States court.

A new electric plant, to cost $200,000, will shortly be added to the Illinois Steel Company's mills at South Chicago, Ill.

The electric light plant of Vanceburg, Ky., has been sold to W. W. McCormick, who will move it to Montgomery, W. Va.

The Southern Electric Light and Power Company, of Philadelphia, the only one not owned by the Pennsylvania Manufacturing, Light and Power Company will on November 23 vote on the question of increasing its capital from $400,000 to $2,000,000.

The $54,000 damage suit brought by the White House Department Company, of La Crosse, Wis, against the Edison Light and Power Company has resulted in a verdict for the defendant. Loss through fire, caused by defective electric light wiring, was the plea made by the department company.

The Common Council of Columbia City, Ind., has purchased the electric light plant owned by a commercial corporation in that town for $21,600. The property is to be paid for in 10 equal annual instalments, and the city will not only operate the plant for street lighting, but will furnish domestic service at cheap rates.

The stockholders of the Newtown, Pa., Electric Light and Power Company have agreed to lease the plant to the Newtown Electric Street Railroad Company. The lease runs for a term of 20 years. It is intended to greatly increase the capacity of the plant, and it is said the new management will spend $40,000 on the improvements.

The American Railway Electric Light Company, of Philadelphia, Pa., has elected the following directors: Alonzo B. Cornell, Edward Valk, Wilbur Huntington, H. Livingston Rogers and H. J. Carr, of New York, and Fred J. Haerer, A. N. Chandler, George W. Crosscup and A. G. Fromuth, of Philadelphia. The president will be elected next week.

The Crescent City Electric Company, of New Orleans, of which Mr. J. B. Craven is general superintendent and manager, and which is backed by enterprising capitalists, has purchased two squares of land at the intersection of Carrollton avenue and the new basin, and will erect a central power station there, commencing the work within 30 days.

THE CENTRAL STATION.

BY SAMUEL INSULL, EX-PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION AND PRESIDENT CHICAGO EDISON COMPANY.

As a result of the experiments at Menlo Park, Mr. Edison, early in the Winter of 1880, started to get together the necessary data for the establishment of a central station and distributing system in New York, in the district bounded by Wall street on the south, Nassau street on the west, Peck Slip on the north, and South street on the east, a territory covering about 2,000 feet square. He had each house thoroughly canvassed to show the number of lights in use, the number of hoistways and elevators, and the horse-power of the engines running machinery.

As a result of this canvass, the Edison Electric Illuminating Company of New York was formed and drawings prepared for a central station, which was erected at 255 and 257 Pearl street, the capacity of the station being 2,000 horse-power, and the district fed by a system of half-round copper mains and feeders, the mains being enclosed in lengths of iron pipe and insulated by a bituminous compound, each length of main being between 20 and 21 feet, so that it was possible to take off a service at each house.

Time will not permit me to go into the details of construction of this, the first commercial central distribution system. You will see, by referring to the outline drawings of the station which I have with me, that the boilers were placed down below and were of the horizontal water-tube type, made by Babcock & Wilcox, carrying a pressure of 125 pounds, the steam machinery and dynamos being of the direct-connected type and placed on a steel structure not dissimilar to that of some portions of the elevated railroad structure in New York.

Great care was taken in figuring out the system of mains and feeders, an immense plot of the district being represented by a series of resistances showing in miniature the probable consumption of current in the various parts of the district. It should be remembered that the path to be followed was practically unknown, that electrical distribution on a large scale was as much of a hidden secret as an unexplored continent, and the remarkable thing is that this first experimental system was a practical success, and a return on the money invested was being earned before electricians at home and abroad would recognize the success of the undertaking. It is but natural that many devices were used which were subsequently absolutely discarded. For instance, an elaborate system of resistances placed in series with the feeders was employed for maintaining an even pressure, entailing a considerable waste of energy. The lamp employed was not more than one-half as efficient as that used to-day, while the cost of manufacture was many times greater, and it had not one-fourth of the life of the present commercial incandescent lamp.

It might be well to pause for a moment and picture the condition of the art at that time. I refer to the winter of 1880. The plans for the central station were completed, the details of construction of the conductors in the street were all on paper, the dynamos and electrical instruments had no existence except on the draughting-board, practically nothing was known of modern methods of insulation or house-wiring, the socket and switch in use to-day had not been thought of, the miscellaneous devices now considered necessary in connection with house-wiring had not been considered. In addition to the development of the system and its installation, manufacturing establishments had to be created in which to manufacture the first material needed, and Mr. Edison and his corps of assistants had to abandon the experiments of the laboratory and the designing of the draughting-room to equip and manage shops in which to manufacture the apparatus necessary, from the generator to the lamp. Others have followed the beaten track, others have improved upon the methods employed, but the conception of the system, the perfecting of the original apparatus, its manufacture, its installation and its early operation were all borne by an enthusiastic but small band of workers having an almost idolatrous belief in their chief as the pioneer of this great industry.

I have brought with me to-night a photograph of the original direct-connected steam generator known as the "Jumbo" machine, used in the Pearl street station, composed of an engine manufactured by Armington & Sims, of Providence, R. I., of the single-cylinder type, running at a speed of 350 revolutions, with what is practically the old form of Edison bipolar machine changed from a vertical to a horizontal position, the armature, instead of being wound with coils of wire, being built up of copper disks and bars. If you will glance from this to the picture of a modern central station unit composed of a compound, triple or quadruple-expansion engine, with a multipolar dynamo connected directly on the engine shaft, you will find that the same broad engineering idea is alike apparent in the earliest and latest central station unit. The improvements in dynamo manufacture have enabled us to use lower speed engines, but the broad principle of direct connection is alike the same in both. That we should come back to exactly what Mr. Edison used in the earliest central station work is no mean tribute to him as an engineering authority.

The delay which necessarily occurs in carrying every new enterprise to a financial success acted as a wet blanket on central station development. Efforts were made to cheapen construction when it was found that capitalists in large cities were unprepared to risk their money in the enterprise. The apparatus was adapted to the requirements of smaller communities, and, as a result, a number of small stations were established throughout the country, especially in Pennsylvania, Ohio and Massachusetts. The development of the central station business for several years was confined to this class of work. The service was far from reliable, owing mainly to the necessity of doing the cheapest possible engineering and construction in order to meet the necessities of the slim exchequers of those who were bold enough to embark their capital in this business; but the Pearl street station, started on September 5, 1882, with 5,500 lamps, rapidly developed, and in the fourteenth month of continuous running had 508 customers, wired for 12,732 lamps. Comparatively little work was done in central station lighting in Europe. A small station was started in Dijon, France, in June, 1883, and in the same year an installation was made in Santiago, Chile; in Milan, Italy; on Holborn Viaduct, London, and in Manchester.

The success of the Pearl street station resulted in the extension of the New York system and the building of two stations uptown in New York, one in Twenty sixth street and the other in Thirty-ninth street. This was followed by a station in Boston and another in Brooklyn. In 1887 the building of the first station in Chicago was started, the average load, as shown by the composite ampere curves of that station, which I have with me, being not much over 500 amperes for the year 1888. These latter stations, the two in New York, the one in Boston and the one in Chicago, were equipped with high-speed engines belted to Edison bipolar dynamos of the Siemens armature type, in some cases the engines and dynamos being on the same floor, in other cases the engines being belted to the dynamos on the floor above. Numerous other stations were started, so that by 1890 upwards of 60 cities were equipped with the direct-current, low-tension systems all of which, and numerous others, are to-day so remunerative that their securities are considered among the most desirable local investments, especially in cities of the first and second rank.

THE H-C DESK TELEPHONE.

The H-C Desk Telephone.

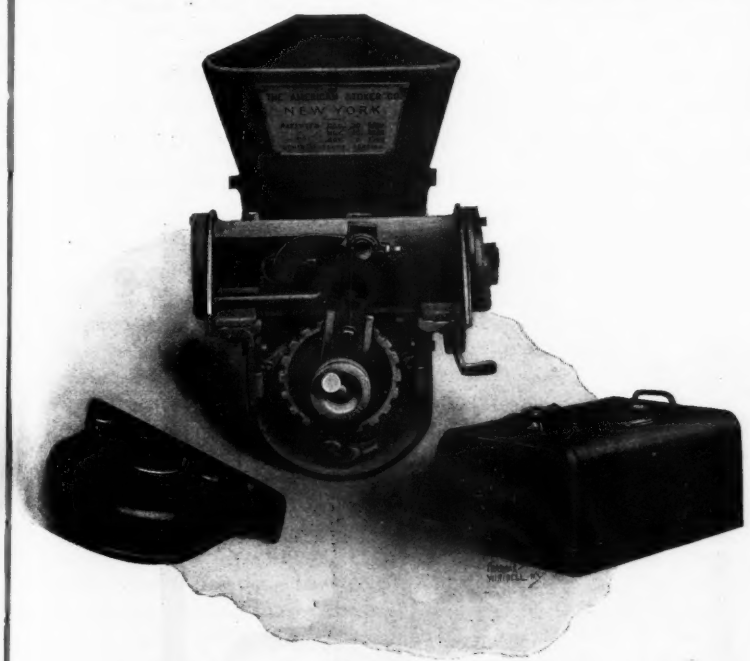
In the illustration herewith is shown a desk telephone set manufactured by the Holtzer–Cabot Electric Company, of Brookline (Boston), Mass The apparatus shown combines elegance in design with solidity of construction and possesses an unusual number of desirable features. Like all the apparatus turned out by this well known company, this telephone set has achieved popularity, not only on account of its inherent merits but also because of the liberality of the terms on which the Holtzer–Cabot company supplies it to customers. The H–C desk telephone is fully described in circulars and catalogues, which may be had from the manufacturers on application.

A new electric light plant, costing $5,000, has just been completed at the House of Refuge, at Baltimore, Md. The dynamo operates 625 incandescent lights of 16 candle-power each, and 14 arc lights.

The American Stoker.

The apparatus manufactured by the American Stoker Company, Broadway and Liberty street, New York, is popularly and favorably known throughout the steam-using world, and especially among electric station managers. The apparatus manufactured and installed by this company presents a thoroughly practical method for the economical use of coal. Not only is a great saving effected in the actual amount of coal used, but the apparatus provides at the same time a practical and efficient method of smoke prevention.

For an apparatus performing functions of the importance and exactness required of a mechanical stoker, the "American Stoker" is simple in its design and construction. Not the least important part of the device is the motor and driving mechanism. Each stoker is driven independently by a small steam motor located immediately in front and beneath the coal hopper. The motor has a small reciprocating piston, shown in the illustration herewith. Its piston rod carries a cross-head, which, by means of suitable connecting links, operates a rocker arm having a pawl mechanism, which in turn actuates the ratchet wheel attached to the conveyor shaft.



MOTOR AND DRIVING MECHANISM OF THE AMERICAN STOKER.

The stoker is thus entirely self-contained and complete in itself, and consequently there is no danger of the driving and feeding mechanism (the only working parts) ever getting out of alignment. The rate of feeding coal is controlled by the speed of the motor, this being effected by the simple means of throttling the steam in the supply pipe to the motor. The shields, covering the motor, effectually protect the mechanism from dirt and dust.

Another New York Telephone Company.

The People's Telephone Corporation, with a capital of $5,000,000, of which $2,000,000 is to be preferred stock, has been incorporated with the Secretary of State of New York. The company will operate lines of telephone from New York city to points within the United States and Canada. The directors are S. B. Dutcher, J. E. Nichols, E. S. A. Delima, Francis C. Travers, Frank Brainard, J. Fred Ackerman and Darwin R. James, of New York city. The preferred stock will be entitled to an eight per cent dividend, which shall be cumulative before any dividend on the common stock shall be declared. The incorporators of the company besides the directors are: S. Cristy Meade, Lee Kohns, Ludwig Nissen, William P. Wiley, James G. Johnson, Washington Winsor, Edward L. Molineaux, E. A. Cruikshank, B. Fisher, Milton Knapp, Charles J. Gillis, J. Fred Ackerman, Eugene H. Conklin, Martin Schrenkeiser, Jere Pangburn, Jr., George Thompson and Alfred Paradis, of New York city, and Frederick Potter and E. A. McAlpin, of Sing Sing. Each of the directors and incorporators subscribes for $1,200 of the stock of the company. The certificate of incorporation says that a telegraph system may also be constructed and operated by the company.

At a meeting of the board of directors held last week, Darwin R. James, president of the Board of Trade and Transportation, was elected president of the People's Telephone Corporation; Elias S. A. de Lima, of the import and export commission firm of D. A. de Lima & Company, was elected vice-president; Frank S. Gardner, secretary of the Board of Trade and Transportation, was elected secretary, and Silas B. Dutcher, president of the Hamilton Trust Company, was elected treasurer.

Litigation Over Boiler Patents.

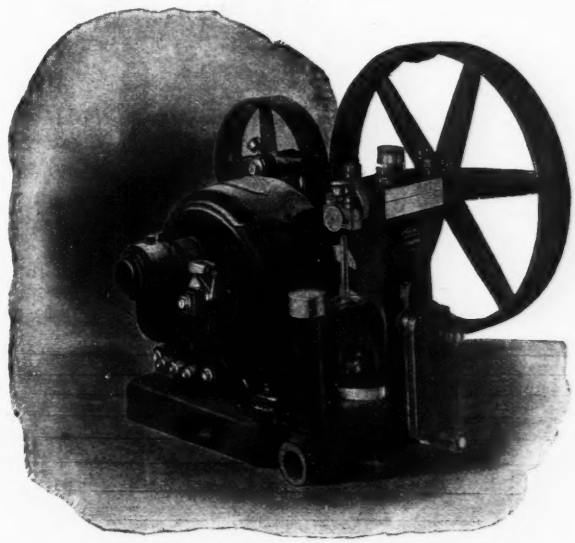
The several suits brought by Thomas F. Morrin and the Clonbrock Steam Boiler Company, of Brooklyn, N. Y., against Thomas J. Lawler and the Edison Electric Illuminating Company of Brooklyn for infringement of the Morrin patents on the Climax boiler have been tried before the Hon. Edward B. Thomas in the United States Circuit for the Eastern District of New York, and have, after long and exhaustive argument, been decided in favor of Mr. Morrin and the Clonbrock Steam Boiler Company. All the patents in suit have been fully sustained.

Dr. S. S. Wheeler Married.

An event of interest to the social world was the marriage of Dr. Schuyler S. Wheeler, president of the Crocker-Wheeler Electric Company, Tuesday afternoon, October 11, to Miss Amy Sutton. The marriage occurred at the bride's home at Rye, N. Y. Mr. G. A. Dunn, chief engineer of the Crocker-Wheeler Electric Company, was best man. After the ceremony, a collation was served by Delmonico.

An Electric Pump for House Service.

A neat and compact pumping outfit for house tank and similar service has recently been put out by Henry R. Worthington. The pump is of the type which is in use for a great variety of purposes, but is especially designed to supply the reservoir tanks of high office buildings and residences, where the pressure carried in the city mains, insufficient to elevate water above the lower stories, must be reinforced by pump pressure. The motor is connected to the pump entirely by belt, and, no cut gears intervening, the operation of the pump is noiseless.



AN ELECTRIC PUMP FOR HOUSE SERVICE.

The motor is of the C. A. type—a type designed and manufactured by the General Electric Company to meet a demand for motors adapted to the direct application of power to small machines. It is built in capacities of two horse-power, one horse-power, one-half horse-power and one-eighth horse-power. The first three are wound for use on 115, 230 and 500-volt circuits, the one-eighth being wound for 115 volts only. They are light and compact and occupy very little floor space, while they may, by a single change in the position of the bearings, be run in any position. The magnetic circuit is of laminated instead of cast-iron; the armature of toothed laminations with coils made up and insulated before application. The motor is mounted upon the base of the pump, making the combination one of the most compact on the market. The motor is stopped and started by an automatic switch, operated by a float on the water in the tank. These pump combinations are built for capacities of 200 and 500 gallons as required.

TELEPHONE NEWS AND COMMENT.

A Long-Distance telephone line connecting St. Louis and Kansas City is under construction.

The Chester County, Pa., Telephone Company will open its office in West Chester about November 1.

The East Tennessee Telephone Company recently filed a mortgage in Nicholas County to the Nashville Trust Company for $150,000.

The Independent Telephone Company, of Lancaster, Pa., has purchased a $12,000 bank building, which will be converted into a central telephone exchange.

The net earnings of the Western Union Telegraph Company for the year ended June 30 were $6,090,151; operating expenses, $17,825,581, and gross earnings, $23,915,732.

The Southwestern Telephone and Telegraph Company has opened a new long-distance line between Texarkana, Ark., and Marshall, Tex., connecting all intermediate points.

Mr. E. P. Wright and Mr. Lee McBride have been elected directors of the Cleveland Telephone Company, filling vacancies caused by the death of George W. Short and Col. William Edwards.

Stockholm, Sweden, is served by two telephone companies, one a state institution and the other a private concern. The latter is the more largely patronized. Almost every lamp-post is provided with a telephone attachment, by which it is possible to call up the nearest cabstand for a carriage or notify the police or fire departments.

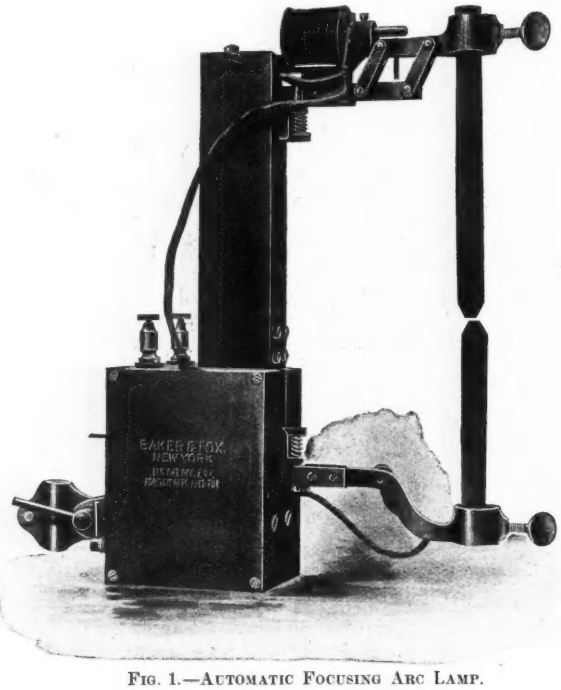


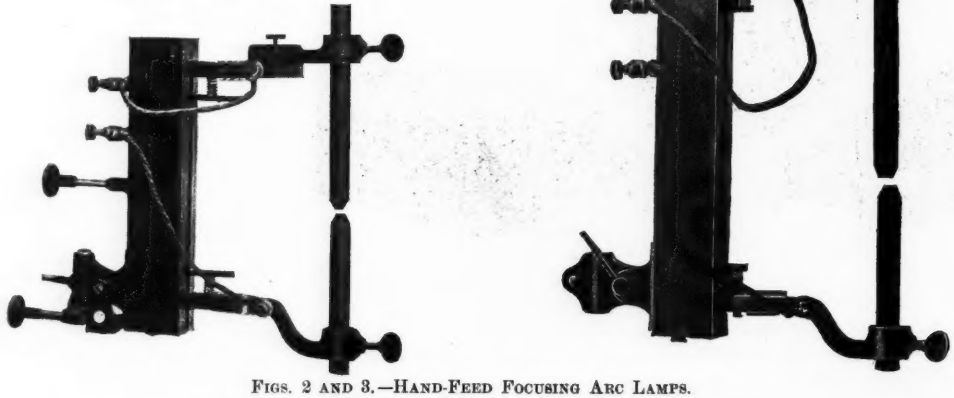
FIG. 1.—AUTOMATIC FOCUSING ARC LAMP.

The Wisconsin Telephone Company has opened a new branch exchange in Milwaukee. It is known as "Lake." The reduction in rates to subscribers in the northeastern portion of the city amounts in the aggregate to a large sum, ranging from $5 to $80 per year per subscriber. The residents of the Lake Park district will benefit greatly by the saving of two miles of distance charge.

The Valley Telephone Company, of Saginaw, Mich., has filed a mortgage covering the issue of $70,000 worth of bonds, issued for the improvement and further construction of the plant. The mortgage runs to Thomas Cranage as trustee. The bonds are dated September 1, and are to be paid in annual instalments of $10,000 each, beginning September 1, 1901. They bear five per cent interest and were sold at par.

A man familiar with the finances of the Erie Telephone Company says that the understanding is that the net earnings of the company for the current year should show an increase considerably above $250,000. Of this amount $200,000 is to be put into new construction, and the balance remaining after Bell Telephone Company's proportion will be carried to surplus account. It is expected that some time in 1899 the company will increase its dividend rate.

John M. Forbes, of Boston, who died last week, was the richest man in New England, and one of the most far-sighted men in finance and politics in this country. He made his fortune in the American house of Russell & Company in China, before the war. His death was due more to old age than anything else, and for many months it had been doubted if he would reach his eighty sixth birthday. One of his sons, William H. Forbes, now deceased, was the head of the American Bell Telephone Company during its successful development



FIGS. 2 AND 3.—HAND-FEED FOCUSING ARC LAMPS.

Focusing Arc Lamps.

A line of focusing arc lamps placed on the market by Baker & Fox, 83 Schermerhorn street, Brooklyn, N.Y., is shown in the accompanying illustrations. The automatic lamp shown in Fig. 1 is made in three types for use on direct current, alternating current, or either. It has a feed motion which is almost noiseless in action and has an excess of power over what is required to bring the carbons to a focusing point. Thus the movement of the apparatus is not affected by dust or grit and requires no attention. The carbon-holders may be set at any height, independent of each other and the feeding mechanism. The arc striking device is so constructed that the carbon is raised and carried backward, causing the crater to be drawn to the front edge of the positive carbon so that its full illuminating power may be utilized. Both carbons being parallel, the arc remains steady and in the same position for the full run.

A hand-feeding attachment is located at the back of the lamp, as is also the key for winding the driving spring. An adjusting screw is situated on the left-hand side for regulating the size of the arc to be maintained. The parts are of the best workmanship and interchangeable. All lost motion, which would induce unsteadiness, is taken up by springs. These lamps require differences of but from .2 to .5 ampere in the main circuit to cause the carbon to be fed.

The hand-fed lamps are made for the same circuits as the automatic lamps and possess many advantages similar to those just described. These lamps are all nickel-plated throughout, unless otherwise ordered.

LITERARY.

The article on "The Navy in the War," by Capt. F. E. Chadwick, of the flagship "New York," in the November *Scribner's*, is the first complete and authoritative account of the many problems that had to be met in the formation of an adequate fleet, and the conclusions to be drawn from the victory before Santiago as to questions of type, construction, etc., of the navy of the future.

The Electric Fan Illusion.

[*From Science.*]

In the issue of *Science* for September 16 (see ELECTRICAL REVIEW, September 21, 1898) Dr. F. C. Kenyon calls attention to the optical illusion to be seen when viewing a rotating electric fan, and requests some explanation of the same. The illusion consists in the apparently capacious reversal of the direction of rotation, and in a corresponding change of the plane of rotation.

This phenomenon has long been known to those who have investigated illusions of motion. So far as the writer's knowledge goes, it was first mentioned in literature in 1860, by the German Sinsteden.* Since that time frequent mention has been made of it, and several explanations have been propounded. The essentials of the illusion can be seen in the case of windmills, electric fans, rotating bars, or rotating disks bearing heavy radial strips of black. For all of these the name of "The Windmill Illusion" is currently employed.

The explanation of the illusion is obviously to be sought in the interpretation of equivocal factors entering into the total experience known as the perception of rotation. Sinsteden, and Helmholtz after him, tried to explain the matter along this line. That eye movements do not enter in has been shown by experiments reported by Dr. Nichols at the first meeting of the American Psychological Association. The essence of the explanation lies in the consideration that the perception of rotation often rests upon the perception of distinct positions of the rotating body, and that the succession of these various positions or phases of rotation admits of either of two interpretations as regards the direction of rotation. That we do perceive motion by means of its phases may be readily demonstrated by rotating a disk bearing variously colored sectors in a dark room, the illumination being furnished by the electric spark. The rotation of the disk will seem to be now in one direction, now in the other, according as any sector, made visible by the instantaneous flash, is seen to occupy a position on this or that side of the sector seen just previously. If in addition any perceived phase could admit of a double interpretation we should have the illusion in question.

The reason for the illusion may, perhaps, be seen in this way. Fancy, for example, a narrow pennant floating from a staff, the observer being so placed that the line of direction of the pennant shall make an angle of, say, 30 degrees with the plane passing through the observer and the staff. Further, let the pennant droop somewhat from the horizontal. If, now, this be viewed from a sufficient distance and by a somewhat dim light, it will prove impossible to determine absolutely whether the pennant is floating towards or away from the observer. That is, we have here a simple case of equivocal interpretation. The same double interpretation is true for every pair of positions between those just considered and the point where the pennant is perpendicular to the plane above mentioned. Suppose now that the pennant be made to rotate about the staff, occupying successively each of these positions. Manifestly the direction of rotation can not now be determined with full satisfaction, for since each of the phases seen was capable of a double interpretation, their succession must give rise to a possible perception of rotation in either of two directions, either from a position more remote to one nearer, or vice versa. Probably one direction will always be selected as real over against the other as illusory, for there are usually some subordinate factors that are dimly perceived which admit of only a single meaning.

Here then we have a type of the illusion. Now let the pennant be replaced by the vanes of a windmill or by the blades of an electric fan, and we find further equivocal factors present. Take the latter case. Not only the direction of the rotation, but the slope of the blades as well may be perceived in two ways. For the patches of light and shade, on the basis of which the slope is perceived, are also equivocal, and the particular illusory perception that we get, not only of the direction, but also of the plane of the rotation, depends upon the special combination of these two equivocal factors. The whole matter is then at bottom one of the perspective interpretation of successive perceptions of light and color in their various combinations.

The above explanation is strongly substantiated by the universally observed fact that the rotating object must be viewed at a certain distance or by a dim light. That is, certain details which admit of but one meaning must be suppressed before the illusion can arise. Again, the fact that the illusion is at its best when the rotating object is viewed very obliquely makes for the explanation given. For here perspective interpretation is given full play. This oblique position of the observer is, however, not necessary in every case, for the writer has repeatedly seen the illusion when viewing a four-vaned windmill directly *en face*. Further, this explanation is strengthened by the fact that the illusion is most clear when one eye is covered.

Which one of the rotations shall in any given case be seen, when either is equally possible, will depend probably upon the position of the eyes. This is influential in all equivocal perceptions, and, as Wundt has pointed out, the law seems to be that the point fixated appears nearest to the observer.

Attention may be called here to a somewhat similar illusion mentioned by Silvanus P. Thompson in the *Quarterly Journal of Science* for 1879. If a crow be seen at dusk flying low against the sky the wings, seen alternately above and below, give the appearance of a single wing rotating about the crow's body like the blade of a screw propeller about its axis. The points of similarity between this and the windmill illusion are manifest.

A. H. PIERCE.

Amherst College.

*Poggendorff's Annalen, CXI.

Mr. Kenyon's optical illusion, described in your issue of September 16, may be best explained by another illusion with which I have been long familiar.

Take an ordinary glass goblet, tilt it a little from you, so that the farther rim is seen through the glass. Shut one eye, so as to get rid of binocular perspective.

You can now at will change the relative position of the two parts of the rim. At one moment you see the farther rim through the glass in its true position; at another it seems the nearer of the two, and you seem to be looking into the mouth of the goblet.

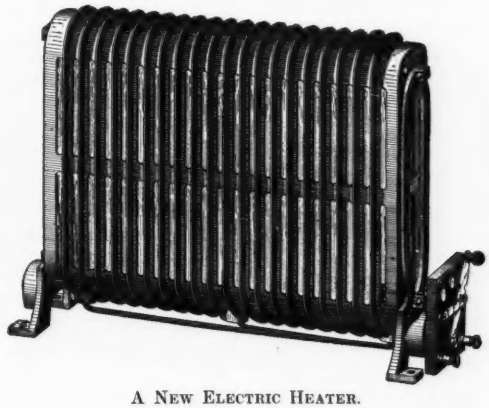
Now, if the glass were rotating, it is evident that it would seem to rotate in the one direction or the other, according as we imagined the real or the reversed position of the rims.

The phenomena can be seen with both eyes open, but is clearer with one eye shut for the reason already given.

Now, I think the phenomenon of the rotating fan is explained in a similar way. The observer, I suppose, looked at the fan from a little below the horizontal, but seemed to be looking at it from above, when the rotation was apparently reversed.

JOSEPH LECONTE.

Berkeley, Cal., September 24.



A NEW ELECTRIC HEATER.

A New Electric Heater.

The electric heater has a wide field of application in heating small offices, bath-rooms, snuggeries, cold corners of rooms, street railway waiting-rooms, the Summer villa on cool evenings, and in mild climates a still wider range. It has the peculiar advantage of being instantly available, and the amount of heat is regulated at will. The heaters are perfectly clean, do not vitiate the atmosphere and are portable. No definite rule can be given to determine the amount of electricity necessary for heating a given space, though approximate estimates can be made by allowing from one to two watts for each cubic foot of air space to be heated, the latter amount for well constructed buildings in cold weather or for quickly heating a bath-room. The electric heater is extremely valuable in the late Spring when furnace fires are not in use and a sudden raw spell comes on, as the electric current is immediately available and takes the chill from the room at a minimum expense and trouble.

The Western Electric Company's heater, made in the shape of a small steam radiator, is 14½ inches long, three and three-eighth inches thick, stands 12½ inches high and is finished in black enamel or japan. It is made for two adjustments, half capacity and full capacity; the switch indicates when the current is off, when half of the heater is used and when it is all in use. The heater is made for 52 and 104 volts, suitable for alternating currents and also for 110 and 220 volts to be used on direct-current circuits.

ADVANCE INFORMATION

Electric Light and Power.

NEW YORK, N. Y.—Union Incandescent Light Company has been incorporated; capital, $8,000; directors, Lion Pistner and Jacob Hillkowitz, of New York city, and Samuel Korf, of Brooklyn.

PHILMONT, N. Y.—The contract for lighting the streets of this village has been let to Mr. Farnham, of Castleton.

DUNCANNON, PA. — An electric light plant, to cost $6,600, is to be erected at this place.

MANAWA, WIS.—An electric light plant is to be established here.

PATTON, PA.—An electric light plant is to be put in at this place by George S. Good, of Lock Haven.

ORANGEBURG, S. C.—The Mayor may be addressed concerning construction of electric lighting plant.

FLORENCE, ALA.—The Florence Cotton Oil Company will install an electric light plant at its mill.

CRESCENT CITY, FLA.—C. H. Cash and W. J. Pierpont have petitioned for electric lighting franchise.

COVINGTON, KY.—The Mayor may be addressed concerning construction of electric light plant.

SARATOGA SPRINGS, N. Y.—Albert L. Judson, of Albany, has applied to the Board of Street Commissioners for a franchise for an electric light and gas plant to be established in this city.

New Telephone and Telegraph Companies.

COTTONWOOD, MINN.—The Southern Minnesota Telephone Company, controlled by the Bell company, has just completed its line to this place, and is now at work placing instruments in most of the leading business houses and several private dwellings. This gives direct communication with St. Paul and Minneapolis.

HARRISVILLE, W. VA.—A telephone exchange is to be established at this place, with branches to surrounding towns.

POCATELLO, IDA.—The telephone line has been completed to Ross Fork.

BROWNSON, FLA.—An effort is being made to have a telephone line erected from this place to T. W. Shand's turpentine still, and thence to Albion & Camp's phosphate mines.

ST. CHARLES, MO.—A petition has been filed by Charles Rexroth, John Koester and E. B. Robertson, of Dutzow, asking for a franchise from St. Charles County. They propose to erect a telephone line, which will run from Dutzow to Femme Osage and Augusta. A branch of the same system will cross the river at North Washington by means of cable. and connect Washington with this side of the river.

THOMASVILLE, N. C.—The Thomasville Telephone Company has been incorporated by F. S. Lambeth, J. W. Lambeth, C. A. Julian, J. F. Haden and others, to establish a telephone system in this place and the surrounding country; capital stock, $6,000.

MOUNDSVILLE, W. VA —Panhandle Telephone Company has been incorporated, with a capital stock of $50,000.

GRAFTON, VA.—The Grafton Telephone Company has been incorporated, with a capital stock of $10,000.

BORDENTOWN CITY, PA.—A new telephone company has been granted a franchise.

DELTA, PA.—The Delta Telephone Company is completing arrangements to build a new line to Peach Bottom.

New Electric Railways.

WEST CHESTER, PA.—A right of way has been granted to the Philadelphia & Castle Rock Railway Company to enter this town by way of Gay street to Matlock, which place will be the terminus of the new trolley road, which will be in operation by about December 10.

WORCESTER, MASS.—A charter has been issued to the Worcester & Webster Street Railway Company to start near the city hall in this place, running through Auburn, Oxford and Webster to the post office in the latter town, about 15 miles. The capital is $150,000. The directors are Julius Garst, G. A. Bigelow, E. L. Parker and F. P. Knowles, of Worcester; E. S. Hill, of Webster; L. E. Thayer, of Oxford, and H. S. Shaw, of Webster.

MADISON, IND.—The proposed electric railway between this place and Hanover is again being agitated.

JEFFERSON CITY, MO.—The Sedalia Electric Railway Company has been incorporated, with a capital stock of $400,000; incorporators, C. H. Reeve, J. C. Delong and others.

NILES, MICH.—The Indiana Electric Railroad, now building a line from Goshen to South Bend, Ind., will extend the line through this place to Chicago.

SPRINGFIELD, OHIO—An electric line is to be constructed from here to Dayton, and the capital stock of the Dayton, Springfield & Urbana Railway Company is to be increased to $1,000,000.

New Incorporations.

SAN FRANCISCO, CAL.—The Electric Railway and Manufacturers' Supply Company has been incorporated. The incorporators are Allen S. J. Bowie, Samuel H. Taylor, Frank Frisbee, Henry P. Bowie and H. S. Hagan. The capital stock is $50,000.

CHICAGO, ILL.—The Metropolitan Electrical Supply Company has been incorporated; capital stock, $15,000; incorporators, Wm. H. McKinlock, Walter N. McKinlock and George Dickinson.

INDUSTRIAL NOTES.

The general eastern office of the Siemens & Halske Electric Company, of America, has been removed to the Land Title Building, Philadelphia, Pa. Their New York office for local business (Metropolitan district) is now located at Room 511, Cable Building, No. 621 Broadway, New York city.

Huebel & Manger, Brooklyn, N. Y., are sending out their new catalogue, which contains all their new and improved articles. The quality of their goods has been kept up to a high standard, and the prices are up to date. Good goods at moderate prices get the trade and hold it, and Messrs. Huebel & Manger believe in this method of doing business.

The United States Carbon Company, of Cleveland, Ohio, is incorporated to manufacture all carbon articles used in the electrical industry. A special feature is the manufacture of high-grade enclosed arc carbons, also the open arc cored carbons and copper-plate arc carbons. The company has a new plant equipped with modern machinery, and is prepared to manufacture the largest and more difficult shapes demanded by the new electro-metallurgical processes.

The Okonite Company, of New York, has enjoyed a particularly prosperous year so far during 1898, the orders from the United States Government, from telephone companies and electric light companies for the widely known Okonite wires and cables being larger than ever before in the company's history. The demand for street-railway feeder wires has also been quite large. The quality of the Okonite product has never deteriorated, and this fact has kept all old customers and brought many new ones.

The Fall catalogue of the Upton "Midget" arc lamps should be in the hands of every person interested in electric lighting. The Standard Thermometer and Electric Company, Peabody, Mass., the manufacturers, make these lamps for every circuit and for every service, both as to interior and exterior lighting. The name "Upton" has been before the electric field almost since the advent of light from the electric arc. The forms of enclosed lamps now made in this factory represent the most advanced ideas as to electrical and mechanical construction.

The incandescent gas mantle became undoubtedly popular immediately after its introduction, and not until the public had purchased its experience was it willing again to listen to information regarding the real significance of the mantle. The General Electric Company has done much to give accurate information to the public, expending considerable sums of money in test and experiment, and publishing the results at its own expense. We have just received from that company a small pamphlet on the "Depreciation of Candle-Power of Welsbach Mantles," giving the results of interesting tests made both in mantles and electric incandescent lamps. It contains information of use to every electric light station manager, as well as to the general public, and will be sent by the General Electric Company to any one interested, on application.

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ISSUED OCTOBER 4, 1898.

(Concluded.)

611,559 Electric railway system; Geo. L. Campbell, Dushore, Pa.

611,996 Apparatus for cleaning ship's plates; W. P. Freeman, New York—Consists of a rotary shaft, and a cleaning device consisting of relatively adjustable sections and movable as a whole longitudinally upon the said shaft.

ISSUED OCTOBER 11, 1898.

612,009 Process of and apparatus for electrolyzing sea water; G. B. Baldo, Trieste, Austria-Hungary.

612,015 Lightning arrester; C. C. Chesney, Pittsfield, Mass.—In a system of Distribution, the combination of a lightning arrester and a coil having portions reversely wound in close proximity to each other, said coil being placed between the lightning arrester and the apparatus to be protected.

612,038 Electric switch; G. W. Hart, Hartford, Ct.—An electric switch consisting of a base of insulating material, contacts mounted thereon, and operating mechanism having a switch-plate in operative relation to said contacts, said base being cup-shaped, and having in its outer walls open grooves leading from the bottom of said base to said contacts.

612,068 Electric railway; F. D. Sweet, Elyria, Ohio.

612,122 Electrical converter; F. Schwedtmann, St. Louis, Mo.—A suitable casing for the reception of the core, said casing communicating with the external atmosphere at or near its top, and an air passage or passages communicating with said casing at its bottom and with the external atmosphere at a point intermediate between the bottom and top of the casing, whereby the converter may be used either with or without a liquid.

612,123 Electrical connector; F. Schwedtmann, St. Louis, Mo.—An electrical connector, consisting of an inner and an outer member, having smooth contact surfaces, one of said members being tubular and slit along a portion of its length to form a plurality of tongues or strips, and an annular spring for forcing said tongues or strip against the other member, said annular spring having its axis coincident with the axis of said tubular member.

612,132 Electric trolley device; C. L. Jeffrey, Johnstown, Pa.—Consists of a lock for preventing said movement, said lock being actuated by the lateral movement of the trolley device when the same is in a predetermined vertical position.

612,139 Casing for electrical car-lighting apparatus; W. F. Richards, Buffalo, N. Y.

612,146 Electric system of distribution; J. N. Thomas, Johnstown, Pa.—Consists of disconnected contact sections of an electric railway of the subsidiary junction boxes, one beside each disconnected contact, feeders passing through said subsidiary junction boxes, and a short contact feeder connected thereto and leading from within the said box to the disconnected contact beside the same.

612,152 Electric lamp socket; F. M. Bell, New York, N. Y.—A socket comprising a casing, a base of insulating material arranged therein, a central contact and contact fingers arranged upon said base, and a spiral supported by said contact fingers.

612,192 Hinge conductor for electric currents; F. E. Chandler, Brandon, Vt.

612,203 Controlling switch for electric motors; Reese Hutchinson, Mobile, Ala.

612,212 Rheostat; E. O. Raster, Chicago, Ill.

612,219 Telephone central-station apparatus; J. H. West, Berlin, Germany.

612,234 Electric traction apparatus; R. Demeuse, Brussels, Belgium—Consists of electro-magnets and their armature, of wedge-blocks arranged on opposite sides of said armature, depending hinged and spring-pressed flaps to receive the wedge located on the upper side of the armature, and upwardly extending springs to embrace the wedge located on the upper side of said armature.

612,324 Automatic door-opener; W. H. Frazier, Denver, Colo.

612,326 Electric battery; M. E. Fuld, Baltimore, Md.

612,344 Underground electric railway; C. W. Jenkins, Richmond, Va.—In a circuit for electric railways, the combination with the conduit framing, of the transverse wooden beams, the insulators thereon, and the wooden side beams connected with and supporting the transverse beam and secured at their ends to the conduit framing.

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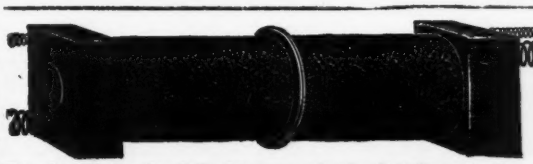

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Kindred.... ...Interests

The Central Electric Company, of Chicago, in addition to their regular large stock of all kinds of standard and special telephone wires, are carrying full stocks in all sizes of special-tinned annunciator wire for telephone switchboard work.

McKenney & Waterbury, 181 Franklin street, Boston, are making a type of corrugated silver glass reflectors for electric lights which will undoubtedly be greatly appreciated in offices and other places where a large amount of electric light is used.

The Pittsburgh Transformer Company, Pittsburgh, Pa., has issued an attractive catalogue illustrating and describing its type "K" transformer. Some novel departures in transformer construction are described. The catalogue may be had on application.

Wilbur B. Driver & Company have opened offices at 126 Liberty street, New York, and will act as sales agent for the "climax" resistance wires made in the factories of John A. Roebling's Sons Co. These wires are produced in all sizes from No. 5 to 36 Brown & Sharpe gauge.

The "Newton" Specialties—flush switches, fixture-arm switches, bug cutouts, etc.—are to be found in a large number of the finest modern buildings. The Newton Appliance Company, the manufacturers, have large factory facilities in Newark, and offices at 120 Liberty street, New York.

The Berlin Iron Bridge Company, East Berlin, Ct., are furnishing for the Laflin & Rand Powder Company, Pompton, N. J., the steel roof for one of their storehouses. The building is 45 feet wide and 150 feet long. The roof trusses are of steel, and the roof is corrugated iron supported on steel purlins.

The Westinghouse Electric and Manufacturing Company, Pittsburgh, has just issued two new and interesting catalogues. One describes generators and rotary transformers for electrolytic work, and the other tells about polyphase inductor generators. Both are worthy of careful reading.

The Garvin Machine Company, Spring and Varick streets, New York city, have issued a new catalogue, in pocket size, of an extensive line of machine tools which they manufacture. The catalogue is profusely illustrated, and contains specifications of a wide range of machine tools for all purposes.

The Pennsylvania Electric Company, of Marietta, Pa., Mr. Paul W. Bossart, manager, has just closed what is believed to be the biggest single order for telephones given by an independent telephone company. The Independent Telephone Company, of Lancaster, Pa., gave the order at one time for 2,000 telephones.

The Joseph Dixon Crucible Company, Jersey City, N. J., is out with an attractive calendar blotter for October, informing the world at large that "Dixon's American graphite pencils will be very much worn this month." This stylish (or stylus) assertion is also true of January, September, May, August, November, April, July, March, February, June and December.

The Cabinet Manufacturing and Supply Company, of Cleveland, Ohio, has succeeded the Cabinet Manufacturing Company, formerly of Steubenville, Ohio, and will hereafter make its headquarters in Cleveland, Ohio. This company is prepared to furnish telephone woodwork and all kinds of first-class cabinets at reasonable prices. Their work is guaranteed to be first-class, and samples are shown when required.

Messrs. Huebel & Manger, 281–295 Graham street, Brooklyn, announce elsewhere in these columns the completion of a new catalogue of electrical goods of which they are manufacturers. This company is well recognized as among the best of manufacturing electricians, and the products of the shops are considered standard throughout the electrical trade. The catalogue includes data as to prices, etc., of electric bells, push-buttons and many other electrical specialties.

The Montauk Multiphase Cable Company, 100 Broadway, New York city, has received the following from Mr. Thos. R. Mercein, secretary and general manager of the Milwaukee, Wis., Auxiliary Fire-Alarm Company: "I am pleased to say that the fire department endorses and authorizes your cable for use in connection with our auxiliary system here, Chief Foley telling me recently to go ahead with it. Superintendent Glassner, of fire-alarm telegraph, has expressed himself as satisfied."

The Columbia Incandescent Lamp Company, of which Mr. A. C. Garrison is the progressive secretary and manager, has just completed a number of important improvements and additions to its factory and office. The company is now in a position to more promptly take care of orders than ever, and this will undoubtedly be a source of satisfaction to its legion of customers, for the accumulation of orders during the previous two months was very large. With the improved facilities, as well as the increased capacity, the company expects soon to catch up and be able to resume its usual prompt shipments in a very short time.

The Electric Appliance Company, of Chicago, are calling attention to their new self-contained automatic hook. This hook is exclusively the Electric Appliance Company's design and manufacture, and a number of very strong claims are made for it. It is very easy to install and occupies very little space. It is put together complete and adjusted before shipping, and is therefore sure to reach the customer in good shape. The contacts are always visible upon opening the door, which makes it easy at any time to see that everything is in working order. The hook is constructed with a cam at the back to prevent the lever being bent back out of shape. This hook is apparently a very desirable article.

The large factories of the Clonbrock Steam Boiler Company, at Brooklyn, have the appearance of great activity, and an unusually large complement of men is employed in pushing to completion a greater number of orders than has been offered at this season for several years past. The Morrin "Climax" boiler, of which the Clonbrock Steam Boiler Company are the makers, has been on the market for several years, and is now to be found in a great many of the largest and best electric light and power plants in America. Within a recent period this form of boiler has been installed by Mr. Thos. A. Edison in several of his enterprises, which, perhaps, is the strongest indorsement anything mechanical or electrical could have.

The Goubert Manufacturing Company, of New York city, manufacturers of the Goubert feed-water heaters, state that they are at present exceedingly busy. The magnitude of modern steam plants is well exemplified by the fact that they have just booked the following orders: One 3,000-horse-power heater for one of the New York & Pennsylvania Company's pulp mills; one 3,000-horse-power heater for the Cleveland Railway Company, Cleveland, Ohio; one 5,000-horse-power auxiliary heater for the Metropolitan Street Railway Company, of New York city, making 35,000 horse-power now building for that company alone. They have also just delivered 3,000 horse-power to the People's Electric Light Company, of Newark, N. J. These orders, in addition to regular calls for heaters of smaller sizes, among them 1,000 horse power for the Schenectady Railway Company and 1,800 horse-power for the Citizens' Light and Power Company, of Houston, Tex., are indicative of the magnitude of the business done by the Goubert company.

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